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After the Coal Dispute.

EXACTLY two years ago (ELEC. REV., November 14th, 1924), in editorially announcing the series of articles by an industrial contributor on "Increased Production and Decreased Unemployment," we remarked that the first step in producing an electrical article at minimum cost was the provision of cheap coal and cheap power; these were described as the first essentials of the revival of industry. But we also stated that it was impossible to begin to approach the question of the minimum cost of coal and iron until our coal mines and steel works saw prospects of regular employment. We deprecated State subsidies for industry, but added that funds must be found to enable coal mines to produce a regular output (for stock) and the steel works to produce a regular output (again for stock) at the right price.

Since those views were expressed, we have passed through a period of industrial disturbance unparalleled in extent and, with one exception (that of the engineering strike of 1897) in length—the General Strike and the Coal Trade dispute. Coal has become temporarily dearer and more difficult to obtain; the question of cheaper power has concurrently formed one of our leading national controversies; and a heavy hand has rested upon most of our industries, bringing some of them to a standstill and restraining enterprise in others. Yet it seems that at last we have progressed towards securing a better future in respect of the coal and iron and steel trades, and therefore of bringing about sounder conditions for electrical manufacturing.

The losses sustained by the nation have been estimated at a colossal figure, and for months past our position abroad has been prejudiced, the hands of foreign producing peoples have been strengthened, and the evil effects of our experience cannot fail to be in evidence for a long time to come.

In fighting our internal battles we have given the world a demonstration of the stubbornness of British character just as we have over and over again done when large external differences between our own and other nations have called for the united expression of that peculiar characteristic of our race. History may prove that in the industrial conflict of Britain in 1926 we have been leading the world back to unalterable

economic laws inseparable from our present civilisation; fighting false doctrines and fallacies; and beating back forces which could only have destroyed without prospect of rebuilding better. Time will tell, for the industrial future lies in the lap of the gods.

While the dispute was at its height we refrained from discussing the merits. It had seemed for years, even before the war was ended, that at some time or other an industrial struggle on a large scale was inevitable—a struggle which would demonstrate the relentlessness of economic forces and the importance of principles. Now that cessation of the struggle is near, without staying to enter into discussion of the incidents of its progress or the terms of agreement which are under consideration, and leaving all recrimination to others, though deploring our practice of permitting misleaders to produce so much ruin, we may hope that in the best interests of the nation as a whole it will be found possible for a larger measure of amity and co-operation to enter into the relations of all parties so that conditions may be stabilised, enabling our industries to develop and some of the damage to be undone.

It cannot be imagined, however, that, when the dispute is actually settled, industry will straightway have abundance of cheap coal any more than it can be supposed that the passing of the Electricity Supply Bill will give us all cheap power. There is a long road to travel in both cases before those two essentials of the full development of indusfry and the production of an electrical article at the minimum of cost, mentioned in our opening paragraph, can be reached. We shall arrive there step by step and stage by stage as those concerned co-operate in each new development as it ensues.

What is the industrial outlook at this moment now that swords are being sheathed? The electrical industry, of course, breathes more freely, enjoying a measure of relief that strife is ceasing before its electrical consequences have become more serious. It has still to go on striving to reduce production costs, while it may also find it possible to reduce the amounts absorbed in the selling, handling, and distribution of the finished article, but, apart from these considerations, it stands to gain immeasurably by the revival of other industries, such as heavy engineering, iron and steel, and colliery working and development. And what is the outlook for these? We have read with interest the reports from correspondents in different parts of the country published in last week's *Engineer*. These all go to show, as other reports from various quarters have stated for several months past, that the termination of the coal dispute will lift a weight from many minds and remove shackles from many industrial hands; furthermore, the prospect of more settled conditions, the restoration of confidence, and the freer availability of fuel will release a great deal of work that has been long held up. Prognostication may be a dangerous occupation, but it is not impossible that, while 1926 has been a year of terrible loss through the General Strike and the coal dispute, and all that they have entailed, 1927 may register exceptional activity in trades that long have languished. Even before the agreement was published, our contemporary was, in anticipation of the end, writing of "stimulated interest in markets"; of "a disposition to discuss future business in most sections of trade"; of "arrangements being made in the heavy industries for a big rush of business immediately the strike is over and fuel is readily obtainable"; and of a steel company which had on its books orders which would ensure for its plant employment at a higher rate of production than before the stoppage, for many months to come. This is all very encouraging, and there is much more like it.

Far be it from us to suggest for one instant that all our troubles will soon be ended; if we appear to be inclined to look on the bright side, let it be attributed to a habit of looking out for the best there is to find—a temperament affected by the first thrills of relief after a prolonged period of anxiety—thrills that have been experienced by most of us on several rare occasions since 1914.

The Bill Through the Commons.

On Friday last—greatly to the relief of its Government sponsors—the Electricity (Supply) Bill was given a third reading and passed by the House of Commons; on Tuesday it was to be introduced in the House of Lords. It has been the subject of a strenuous conflict between the bulk of the Conservative Party, supported by the Labour Party, on the one hand, and a group of dissentients, mainly Conservatives, on the other, and has been forced through its stages by party discipline rather than by reasoned argument; unfortunately, owing to the highly technical nature of the subject, very few members really understand its provisions, and the debate has been largely confined to the Ministers in charge of the Bill, their Socialist supporters, and the group of critics, whose attitude has been unfairly ascribed to solicitude for shareholders. We fully agree with them, however, that the Bill holds out no prospect of cheapening the cost of electrical energy, whilst it introduces new and untried principles which affect the whole industry of electricity supply very materially. In the words quoted by Lieut.-Col. Moore-Brabazon, who moved the third reading of the Bill in a very able speech, the company which supplies electricity in the North-East Coast area objects to the Bill because it believes that the Board will "mess them about"—a very significant expression of a view which is shared by many other supply authorities, not without reason (as instanced by a letter to *The Times* reprinted in "Notes" to-day). As the speaker explained, the essence of the Bill is the building of "a grid of interconnecting lines between the various generating stations of this country," and to that great project all else is to be subservient. Admitting that the distributive side and the commercial side of electricity supply were just as important as the generating side, which alone was dealt with by the original Bill, he acclaimed the clause enabling municipal undertakers to sell apparatus as conferring upon them an enormous advantage, and declared that it was even more important to keep up the load factor than to do anything else in electricity supply; on these points we cordially agree with him.

It is indeed a fortunate circumstance that before the Report stage was reached practically all the electrical associations concerned had arrived at a complete understanding with regard to the selling powers and had sent a statement to that effect to every member of Parliament, so that the clause was adopted without a division; it embodies provisions which safeguard the interests of contractors whilst allowing the suppliers freedom to develop their undertakings and to give efficient service to their consumers. We look upon this clause, by which a long-standing controversy is settled, as perhaps the most valuable and effective provision in the Bill, and the only one which attacks the problem of development on its most vulnerable side—that of distribution.

In the course of the final debate severe criticism was directed at the manner in which the Attorney-General had conducted the Bill through the House of Commons, including charges of impatience and discourtesy. To these we would add the comment that in his speech winding up the debate Sir Douglas Hogg made use of statistics in support of his case which were not only inaccurate and misleading, but were also unfairly handled. After quoting the presidential address of Dr. Eccles as that of an expert in favour of the main principles of the Bill, he proceeded to quote figures from the *Economist* for November 6th, relating to the year 1925. Giving the output of electricity per head of population for various countries, to the disadvantage of Great Britain, he ignored the fundamentally different conditions that obtained, which destroy the value of such comparisons. He stated that there was not much water-power in France, which, in fact, possesses more water-power (9,000,000 h.p.) than any other European country, and has actually developed 2½ million h.p.—the same amount as Italy has harnessed. He did not say that in Switzerland, which has no coal, all but one-thousandth part of the energy generated in a normal year is derived from water-power, which necessarily involves the

use of electricity, and he took no account of the fact that where water-power is available enormous quantities of energy are used for electrochemical purposes, a circumstance which renders such comparisons between this country and the United States, Canada, Switzerland, Sweden, France, and Italy utterly futile.

The data published by our contemporary are said to be for the year 1925, and, so far as we are aware, have not yet appeared in any other publication. The *Economist* introduces them as "Some figures given by Dr. W. H. Eccles in his presidential address . . . with some supplementary information from other sources." Most of Dr. Eccles's figures were for the year 1923, and we fail to find many of them in the tables of the *Economist*. We do not know the source of those given for foreign countries, but as regards Great Britain, the figures are new, and can only have been obtained from the Electricity Commissioners. It seems regrettable that they should appear in a financial journal before the electrical Press has had an opportunity of publishing them.

The Contractors' Register.

Two pamphlets—blue and green respectively—have been issued on behalf of the National Register of Electrical Installation Contractors. The blue one contains a reprint of the paper read by Mr. F. W. Purse at the Contractors' meeting at Brighton last June, fully explaining for the benefit of the uninitiated the objects of the Register, the constitution of the Committee, the qualifications for membership, and the progress of the movement down to that date. The author emphasised the need for advertisement and publicity if complete success was to be secured, and urged the contractors themselves, as the people likely to benefit more than anybody else, to bestir themselves. Contractors who have not read that paper or who desire further information should ask Mr. T. Trimnell, the secretary (1, Lincoln's Inn Fields, W.C.2), for a copy of this blue pamphlet. The one clothed in green is not less important—indeed to the electrical trade in general and to engineers, architects, and others who need to know which contractors have received the Hall-mark of Registration and were still on the list on the first of last month, it is far more so. It gives particulars showing the constitution and *personnel* of the Council of Management and a complete list of the names of contractors whose names stood on the Register at the date mentioned. They appear in geographical sections as to city or town in England and Wales, in Scotland, in Northern Ireland, and in the Irish Free State, while the Isle of Man brings up the rear with two names and the Channel Islands with one. We have mentioned the necessity for frequent publication of the complete list so that one may see at a glance what amendments, such as removals from the Register, have had to be made. This pamphlet meets the immediate need, and no doubt inquiries in regard to special cases not appearing therein could be easily dealt with by means of discreet correspondence with the secretary until more frequent publication of the complete Register becomes practicable.

The Birmingham Fair: The Electrical Arrangements.

The Electrical Advisory Committee of the British Industries Fair (Birmingham) met on Wednesday, November 10th, as was announced here last week, and important business was done.

It was reported that down to date there was an increase of 100 per cent. in the amount of space let in the Electrical Section, as compared with that occupied at the 1926 Fair. We are glad to note that the committee has decided considerably to extend its invitations to electrical and allied associations to attend the Fair and be entertained to luncheon, and we hope that every one of these bodies will make a representative tour of the Section somewhere between February 21st and March 4th. The success of some of the functions on the last occasion will be well remembered by those who took part in them. In due course, no doubt, we shall be able to publish the programme of dates, but at the moment we will place on record for our readers' delectation the list of organisations that are to be invited to lunch at the Fair, or to avail themselves of accommodation available for the holding of meetings or conferences should they so desire. We print the particulars of the associations in the very interesting form in which they were received so that the reader may puzzle out for himself to which party he belongs. If after a well-sustained effort he fails to find his particular niche and thinks he ought to be included, let him write to Secretary Jennings, for the doors will be open to everybody interested in the purchase of British electrical products.

I. M. E. A.	A. M. E. E.
M. T. A.	P. E. S. C.
I. E. E.	I. P. F. A.
E. C. A.	A. M. C. M. S.
E. W. F.	A. S. E.
I. A. E. P. C.	E. A. W.
A. C. E. I.	I. E. S.

Though the Manufacturers' Association is not officially represented in the list, this signifies nothing, for the Fair stands approved by B.E.A.M.A., and the invitations are from a committee on which manufacturers are well represented. The details of the Section rest in the care of a sub-committee consisting of Mr. T. R. Martin, Dr. Railing and Mr. E. J. Jennings. With reference to the necessity for doing everything possible to secure the presence of overseas electrical buyers, upon which we ourselves have laid so much stress, the Department of Overseas Trade is to be asked to specially circularise these, while the electrical Press will continue its efforts in this direction.

Electricity Supply Tariffs.

In a letter addressed to an engineering contemporary, Mr. M. R. Meldrum complains of the "complacent attitude adopted by the editors of our leading technical journals," to which he attributes in some measure "the low rate of progress we are making." In particular he lays stress on "the ridiculous plan adopted by most of our municipalities of selling current at different rates, according to the purpose for which it is to be used," involving in many cases duplicate wiring, and he regrets that "criticism of present methods should fail to meet with proper support from those who are leading the professional opinion of the country."

It seems to us that before Mr. Meldrum attacks the technical Press on its treatment of an electrical subject, at least, he should make himself acquainted with the attitude adopted by the electrical Press. This he has not troubled to do. For years past we have contended that tariffs should be as simple as possible, and in particular we have urged that the tariff offered to domestic consumers should require the use of only one meter and one set of wiring in a house, with a simple two-part tariff comprising a fixed charge independent of the meter reading, and a small running charge per kWh consumed.

This is the type of tariff strongly recommended by the Advisory Committee which recently reported to the Electricity Commissioners on the subject, and is already widely adopted. From time to time we have editorially advocated its employment, and so recently as October 22nd, in our "Domestic Electrification Number," Lieut.-Col. W. A. Vignoles, D.S.O., with whose views we are well acquainted, at our request dealt with the subject in an article vigorously supporting the "straight-forward two-part tariff," and inviting supply engineers to "consider this question of tariffs as settled."

So far as we are concerned, therefore, the charge of complacency is misdirected, and, using the words of Mr. Meldrum, "It is much to be regretted that soundly-based criticisms of present methods should fail to meet with proper support"—on the part of hasty correspondents.

A Small Hydro-Electric Scheme.

Construction in an Isolated and Water-laden Area.

A SMALL hydro-electric installation which has recently been completed to supply Shielbridge House, fig. 1, near the little village of Acharacle at the foot of Loch Shiel, Argyllshire, the residence of Mr. Kenneth M. Clark, chairman of the Aluminium Corporation, Ltd., has some interesting features.

It utilises the water power of the small Lochan Craig Dhu, about 2½ miles from the house. The water of the loch has been raised about 8 ft. by means of a dam, fig. 3, 120 ft long by 20 ft. high, and a 15-in. steel pipe line 1,200 yd. long brings the water under pressure

Fig. 1 – Shielbridge House.

Fig. 2.—Power House and Pipe Line.

to the power house, fig. 2, which is situated at the sea level, providing a net effective head of about 260 ft. The water is delivered to a 150-h.p. impulse turbine, 600 r.p.m., supplied by Messrs. Gilbert Gilkes and Co., Ltd., and fitted with a Gilkes patent shaft governor and economiser to obtain close governing and a minimum shock on the pipe line without the use of a heavy flywheel. The governing results obtained on test were extremely satisfactory. With the full load thrown off the turbine, the speed only rose 1 per cent. above the final settled speed, the rise in pressure in the pipe line not exceeding 5 per cent. It is claimed that as the governor pendulum is mounted on the turbine shaft and is automatically lubricated, there is no risk of failure due to broken belts, chains, or gears, or of seized bearings.

The summer flow to the loch is small, and the supply to the turbine is therefore largely dependent upon storage, necessitating economical working. On test a maximum efficiency of 84 per cent was obtained.

The turbine is directly coupled to a 400-V, three-phase Brush alternator, and the inherent voltage drop in the alternator and transmission line is automatically compensated for by means of a variable regulator in the exciter field, mechanically connected to the turbine governor. The pressure is raised to 3,300 V for transmission by a 100-kW transformer, the supply being received first by a single-unit switchboard.

The transmission line consists of three conductors of 3/9 h.d. copper, carried by insulators and cross-arms on poles which were provided by the estate. The erection of the poles had to be very carefully considered; for the first 1,000 yards the line runs along the seashore, as shown in fig. 4, the feet of the poles being under water at times of high tide. The greater portion of the rest of the line runs across a deep peat bog, where the poles had, therefore, to be provided with substantial bog shoes, and stayed both ways to baulks of timber sunk in the bog. These precautions have rendered the line quite stable, even in the strongest winter gales so far experienced.

At the house end the h.p. line is led into a transformer room in an outbuilding, where the pressure is reduced to 230 and 100 V. A substantial distributing switchboard equipped with the necessary indicating instruments controls the l.p. supply to the house, a laundry, garage, greenhouses, and surrounding cottages.

In the house the current supplies, besides lighting, a 30-kW cooking range, made by the General Electric Co., Ltd., a 10-kW hot-water supply apparatus, many radiators of both the hot-wire and thermo-circulation types, and a Frigidaire plant. In the laundry two motors are used for driving ironing and washing machines, each being fitted with epicyclic reduction gear, and the supply is also used for a 12-kW, 50-gallon washing copper, hot-water supply apparatus with a loading of 8 kW, and a hot chamber for clothes drying (10 kW). Each cottage is equipped with an electric cooking range, hot-water apparatus, radiators, a washing copper, and electric lighting.

As the whole of the installation was carried out in a very inaccessible part of the country, over 20 miles from the nearest railway, with no connecting roads, special means had to be adopted for transporting the materials to the site, and it was decided to charter a steamer for this purpose. The vessel made two journeys, the first with the pipe line and such equipment as the contractors' rails, and the second with the generator and transmission plant.

The steamer could only come sufficiently near land to enable its contents to be unloaded on to carts at certain high tides, and could only remain so for a very limited time. This necessitated very careful organising work to have all the goods assembled for shipment at the right time and the necessary labour and carts available at the correct moment for unshipping. The whole of the work, however, went through without a serious hitch, thanks largely to the energy and determination of Major Fletcher, the factor at Ardnamurchan, and the plant was started up at the beginning of May this year, a little more than a year from the time of commencement of the work.

Fig 3.—Lochan Craig Dam.

Fig. 4.—Transmission Line in Sea.

The general lay-out of the installation was designed by The Aluminium Corporation, Ltd.

In conclusion, we are indebted for the above particulars to Messrs. Gilbert Gilkes & Co., Ltd.

Automatic Contactor Gear for Direct-Current Motors.

By G. WINDRED.

In view of the extensive and rapidly increasing sphere of application of automatic control gear in all branches of the electrical industry, some notes on the theory and application of modern automatic equipment should be of general interest.

It would obviously be impossible in the course of a single article to give anything like a complete exposition of such a wide subject, so that the present article attempts only a brief discussion of the salient points of modern practice with reference to direct-current machinery, which is in general much more readily adapted to automatic control than a.c. gear.

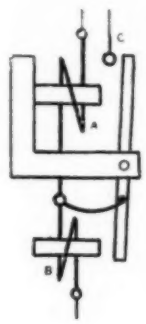


Fig. 1.—Diagram of Current-limit Contactor.

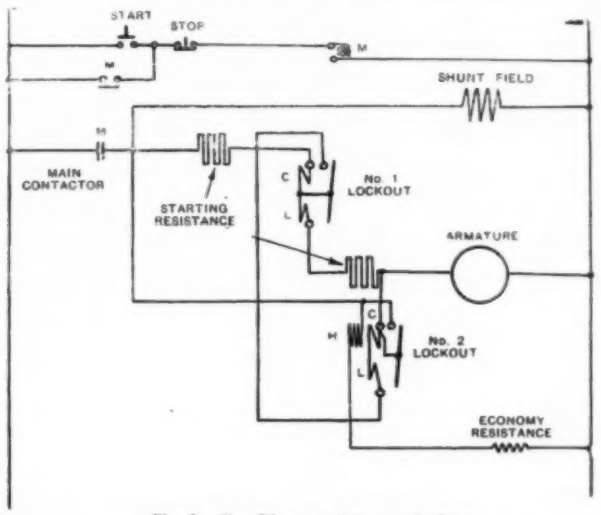


Fig. 2.—Key Diagram of Automatic Starter.

All of the methods of d.c. motor control by automatic means at present in use may be broadly classified under two headings, representing two widely different forms of control, namely:—(1) Current-limit acceleration, in which system the starting period of the motor is determined by the amount of load, and (2) time-limit acceleration, in which the rate of acceleration of the motor is usually determined by the setting of an oil dashpot time-lag device, and is consequently independent of the load on the motor so far as the control gear is concerned.

The former system of control finds application in connection with machine-tool drives and in other cases where the starting torque required is not constant, and where it is desirable that heavy loads shall be accelerated more slowly than light ones.

The latter system, which is perhaps more frequently encountered in practice, is employed in cases where the starting period of the motor is of importance, and the machine is required to accelerate in approximately the same period over wide ranges of static load. As a typical example of these requirements, the duty of passenger lift motors may be cited.

For the purpose of the present article it will be convenient to consider each method of control under a separate heading.

Current-Limit Control.

In most of the existing schemes of automatic control by the above method, the starting-peak currents in the motor circuit are utilised to prevent the removal of the successive steps of starting resistance until the motor current fails to a predetermined value. There are numerous types of automatic switch by means of which these conditions may be obtained, one form, possessing very simple constructional features, being shown diagrammatically in fig. 1, where A indicates the main or closing coil, and B the "lock-out" coil of the contactor, the contacts of which, shown at C, are arranged to short-circuit a section of starting resistance when the contactor is closed by the action of coil A. The external connections of the contactor are arranged so that when starting, the motor current flows through coils A and B in series, but the magnetic circuits are so proportioned that for large currents, such as occur during starting, the pull of the lock-out magnet B is more effective than that produced by the closing coil, with the result that the contactor remains open owing to the fact that the pulls produced by the respective coils, being on opposite sides of the armature pivot, are in mechanical opposition. As the speed of the motor increases and the current consequently falls, however, the pull of the lock-out member falls off more rapidly than that of the closing member, with the result that at a predetermined value of current the contactor closes, short-circuiting the starting resistance or a section of the starting resistance as the case may be.

In cases where more than one accelerating switch of this type are employed the connections are arranged so that the closing of the first switch brings the second and succeeding switches into operation in their correct sequence.

It will be obvious from the foregoing explanation that the time which elapses between the closing of each contactor and the next will be dependent upon and proportional to the current in the motor circuit, and hence to the load on the motor.

A key diagram of connections for an automatic starter using two steps of acceleration is given in fig. 2. When the lock-out type of contactor is used as a final accelerating switch it is necessary to provide a shunt-wound holding coil for keeping the switch closed when it has operated. This coil is shown at H in the diagram, fig. 2.

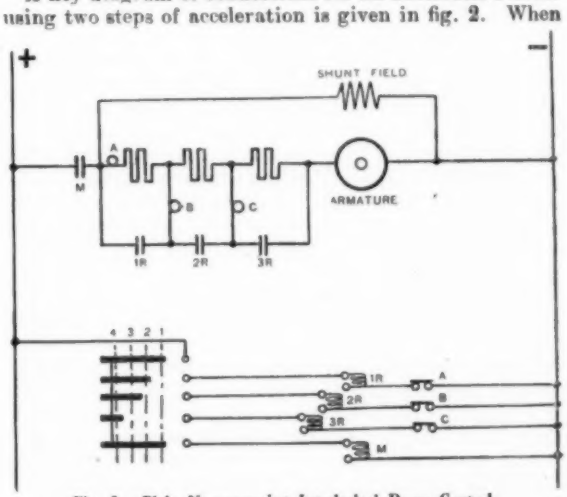


Fig. 3.—Plain Non-reversing Interlocked Drum Control.

Another type of contactor used for current-limit acceleration has an auxiliary relay movement which is kept open when the contactor is open, but which is free to close its contacts when the contactor closes, but is pre-

vented from so doing electrically by the action of a series-wound solenoid coil which carries the motor current when the contactor closes. When this current falls to a predetermined value the relay contacts close, thereby energising the operating coil of the succeeding contactor. This type of switch does not possess the advantages of the lock-out type, owing to the presence of small relay contacts and the necessity of providing shunt-wound operating coils, which are, of course, more liable to electrical breakdown than series coils.

In the case of steel mill or crane control gear, the series accelerating relays are usually separate from the contactors, which are operated in the correct sequence by means of a drum-type controller, but prevented from closing in too rapid a sequence by the series relays, which are arranged to complete the circuit of the corresponding contactor coils only after the current in that branch of the motor circuit has dropped to a value predetermined by the setting of the relay. The diagram, fig. 3, shows how these conditions may be obtained, and illustrates the simple case of a plain non-reversing drum controller interlocked by the series relays shown at A, B and C. The first position of the drum energises the main contactor coil, M, thus connecting the motor to the line in series with its starting resistance. If sufficient time is allowed for the current to die down before moving to the second point, this will result in contactor 1R closing, and cutting out a step of starting resistance. The surge of current which results from this operation now only energises relay coils B and C consecutively, preventing the closing of 2R and 3R until the desired current

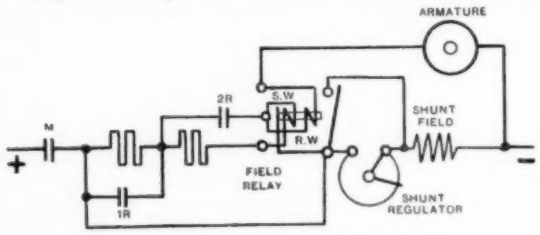


Fig. 4.—Relay for Interlocking Shunt Regulator.

value is arrived at. In this way too rapid operation of the drum controller is rendered harmless, since the starting-current peaks are in this case taken care of by the series relays, which are adjusted to close in the correct sequence.

In control systems wherewith regulation below the normal speed of the motor is required, it is usual to insert a suitable adjustable resistance in series with the motor in order to reduce the p.d. across the motor terminals. The amount of resistance required for this purpose depends, for a given machine, upon the load and upon the speed-torque characteristics of the load. For instance, in the case of a motor driving a ram pump against a constant head of water, the torque which must be developed is approximately constant at all speeds, so that the speed-reducing resistance must be designed to drop the required proportion of the line voltage with the normal-load current flowing. In the case of centrifugal pumps, or propeller fans, however, the torque required varies over the speed range, approximately as the square of the speed, so that the resistance must be sufficiently high to produce the required p.d. at the motor terminals with only a fraction of the current corresponding to normal speed flowing in the armature. As an example of this effect may be taken the case of a shunt-wound motor running at a normal speed of 1,000 r.p.m., corresponding to a current of 20 amps., and driving a propeller fan. If the speed is reduced to 800 r.p.m., the current, being proportional to the torque, will be $(800^2/1{,}000^2) \times 20 = 12.8$ amperes, and at 500 r.p.m. it will be $(500^2/1{,}000^2) \times 20 = 5$ amperes; if the speed is further reduced to, say, 200 r.p.m., it is found that the motor current will be less than one ampere. These characteristics obviously necessitate the provision of more series resistance than would be required to give the same speed reduction on a constant-torque load, but since the currents carried by the resistance in this case are correspondingly smaller, the bulk of the resistance is in general similar in both cases. For small- and medium-power motors, up to about 12 h.p. for 220 volts and above, speed regulation by the plain series method described above may be conveniently obtained by the use of hand-operated, drum-type controllers or even suitable face-plate-type regulators; but for larger machines, and for such conditions of operation as obtain in steel mills and similar places, it is usual practice to employ a contactor panel working in conjunction with a drum-type master switch arranged for handling the contactor coil circuits, and giving a suitable number of speed steps. In practice a four- or five-point master drum is found suitable up to about 45 or 50 h.p., while up to 100 h.p. a nine- or ten-point drum should be used. For larger motors, some form of multi-speed drum is employed.

Dynamic Braking.

If a suitable resistance is shunted across the armature terminals of a d.c. motor when unexcited, and with the armature revolving, it is obvious that the circuit will be analogous to that of a loaded generator, and a current will flow proportional to the e.m.f. being generated by the motor, *i.e.*, proportional to the speed for a given value of resistance. Under these conditions, therefore, the armature is subjected to a retarding torque proportional to the current flowing, and hence inversely proportional to the value of the bridging resistance.

This effect is often utilised in d.c. control systems for rapidly stopping the motor after shutting down, and is known in this connection as dynamic braking. This is a very simple and at the same time reliable method of producing a braking effect, and finds extensive application in practice, more particularly in connection with electric traction, where it is desirable that the deceleration shall be gradual and uniform. In practice it is usual to employ a normally closed contactor for the dynamic braking circuit, the contacts of the switch being arranged to complete the dynamic resistance circuit with the contactor coil de-energised, that is, with the controller in the " off " position. When the controller is operated on any of the speed points, the dynamic contactor coil becomes energised, thus disconnecting the dynamic resistance, and allowing the motor to function in the ordinary way. On moving the controller to the " off " position, however, the contactor switch closes, thereby shunting the motor armature through the dynamic resistance and giving rise to the conditions of dynamic braking. For large motors it is usual to provide several steps of resistance for this purpose, corresponding to different degrees of braking, which under these circumstances takes place more uniformly.

Speed Regulation by Series Diverter.

An extension of the principle of dynamic braking having a wide field of application in connection with the control of the speed of d.c. motors below normal is known as diverter control.

In this system, the motor has its armature shunted by a suitable regulating resistance, while the motor is connected to the supply lines with its series resistances in the ordinary manner. Under these conditions it is obvious that the p.d. across the motor armature is reduced in proportion to the value of the diverter resistance, owing to the increased drop in the series resistance, and there is a consequent reduction in the speed of the motor. By adjustment of the amount of resistance shunting the armature it is, therefore, possible to obtain speed regulation with this method, which is used very extensively in practice in the case of large motors operating over wide ranges of speed.

Speed Control by Shunt Regulation.

When a speed greater than the normal speed of the motor is required, it is necessary to employ shunt regulation, about which little need be said except with reference to the various methods which exist for preventing the starting of a motor with a weak field. This protection is, of course, very necessary in the case of large motors, since the connection of these machines to the line at starting with any appreciable shunt field resistance in circuit would result in heavy starting-current peaks and abnormal acceleration.

An interesting form of relay, designed for the interlocking of shunt regulators, is shown diagrammatically in fig. 4. From this diagram it is seen that the relay has two separate series windings, one of which remains in the motor circuit continuously, while the other winding is arranged so as to be short-circuited when the final step of starting resistance has been cut out of the motor circuit. The contacts of the relay, which are normally open, are arranged so as to short-circuit the shunt regulator, as shown in the diagram, while the air gap of the relay is adjusted for a given motor so that the relay will close at approximately 40 per cent. of the normal full-load current of the motor, thereby ensuring that the relay will close under light-load starting conditions. The running winding R.W., which remains in circuit continuously, is arranged to operate the relay at about 120 per cent. of the full-load current with current flowing in this winding alone. From the foregoing it will be seen that immediately upon completing the motor circuit, the relay closes, and its contacts short-circuit the shunt field regulator. When the starting current falls below about 120 per cent. of the full-load current, *i.e.*, after cutting out the last steps of starting resistance, the relay opens, inserting the whole of the shunt regulator resistance not short-circuited by the regulating lever. This, of course, results in a peak current, dependent upon the amount of regulator resistance inserted in the shunt field, and if this peak is more than, say, 120 per cent. of the full-load current, the relay closes again. During the period which has elapsed, however, the motor has, of course, speeded up, and the alternate opening and closing of the relay gets more rapid as the current decreases and the speed increases until finally a steady value of current is reached with which the motor will continue to operate at the speed corresponding to the previous setting of the regulator.

This form of field interlock has the important advantage of giving "pre-set" speed control, and is consequently found very useful in practice in cases where the speed is required to be constant when once set by the shunt regulator, and where re-adjustment of the regulator each time the motor is started would be an undesirable feature.

In the case of hand-operated motor starters where it is possible to mount the starting and regulating levers together, it is usual to resort to some form of mechanical interlock between the two levers, which renders it necessary to return the starting lever to the "off" position before shunt regulation can commence. With this form of interlock, of course, the speed of the motor is not "pre-set."

Where automatic control is employed, it is possible to arrange an auxiliary normally-closed contact to each accelerating switch, these contacts being arranged to short-circuit consecutive portions of the shunt regulator resistance with the accelerator in the open or off position. When the first accelerator is operated, the corresponding auxiliary finger will open, thus inserting a suitable section of the regulator resistance. When the second accelerator closes, still more of the resistance is put into circuit, until in the full-speed position all the shunt regulating resistance not short-circuited by the regulator lever is in circuit. This method, therefore, also gives "pre-set" speed regulation.

Conclusion.

The foregoing remarks are intended to be briefly descriptive of modern procedure in connection with automatic direct-current motor control gear. It is, of course, impossible to go very thoroughly into details in the course of a single article, so that the scope of the present article is limited to a discussion of the most salient points of the subject.

Electricity Supply and Industry.

The Necessity of Efficient Organisation.

By G. L. E. METZ.

THERE seems little doubt that the present interest and activity in electricity was stimulated very greatly by the trouble in the coal fields a few years ago, which resulted in investigations being made into the economic mining, and use, of coal.

In the reports that were got out for the Government at the time, attention was drawn to the appalling wastage of fuel, and it was hinted that coal found one of its most important uses in the production of electrical energy. The time at which these reports were made happened to be one of industrial slump, and after examining the various causes which might have been responsible for the depression, economists came to the concusion that a cheap and abundant supply of power in an electrical form would soon bring a return to a happier industrial state.

The writer ventures to suggest that this result was most probably obtained by a process of elimination, which was carried on until there was nothing left to do but to bank on the unknown—electricity.

This combination of circumstances has put electricity into a very similar position to that of the ether. Just as the latter acts as a mythical pack-horse to help scientists, so industrial experts of recent years are prone to find electricity no mean friend when other allies fail.

In the realms of science, however, the problems usually begin and end on a piece of foolscap paper, and the introduction of a little ether, more or less, is possibly of no account; but in the application of science to industry, a beginning founded on theory is expected to produce a very material financial result. For this reason it is felt that a little more caution is required in certain quarters in saddling electricity too heavily with industrial responsibilities which it can never discharge.

Extracts from the lay Press are of interest: many writers calculate the millennium to fall about five years after the nationalisation of electricity. Expert advisers, economic and industrial giants, and special correspondents, predict that the dole will no longer be required; in fact, it will be difficult to get sufficient labour to cope with the great influx of work. The electrical wave shall pass over the industrial desert, and it shall blossom like the rose!

Other authorities upon the subject foresee the coming of industrial revolution, and have discovered that productivity, and high wages, are a direct function of electrical engineering development. The latter is pleasant news to engineers, for it has been very difficult to find any connection between high wages and electrical engineering in the past.

Summing up the whole question, it can be seen that the subject has been lightly dealt with by the lay Press, and many statements have been made which have no foundation in fact and are mere forms of speech.

The provision of a cheap and abundant supply of electricity will have a very definite effect: but suppose it were available at the present time—would it make such an enormous difference to the cost of production in industry generally? In the opinion of the author it would not. The secret of industrial prosperity is not cheap power, but efficient organisation.

The lack of co-ordination in a number of industrial concerns, coupled with supreme contempt for the rudi-

ments of business routine, is possibly a greater source of loss than anything else.

How many concerns know the real cost of manufacture of the articles they produce, or consider the costing department—if they have one—as anything more than a luxury?

The system of handling orders from estimating departments through drawing office, shop, and test is often such that no one man is in a position to give information about it.

How many concerns give strict attention to tool rooms, process work, inspection, or motion study, or even consider such things of business significance?

It would be very interesting for a number of engineering firms to ascertain exactly what it cost to look up information relating to a contract two years old; or, say, the cost of a man replacing a broken drill out of stores—quite a simple but illuminating study.

Were electricity utilised for small process work now done manually, the loss due to inefficient organisation would become greatly exaggerated.

Electricity cannot be administered to an industry suffering from senile decay and produce the cleansing, invigorating effect of a dose of castor oil; and even if it could, the patient wouldn't like it.

To take full advantage of a cheap and abundant supply of electricity, it is imperative that its uses be confined to processes that follow a logical and complete sequence of operation, which only exists in well-organised concerns.

The present plan of closing wasteful generating stations and replacing them with a small number of large stations, interlinked, is sound practice and will result in the more efficient generation of electricity as a whole; but its effect upon industry depends very largely upon the efforts the latter makes to reorganise and adjust itself to what might well be termed a change in life.

Many readers will know of concerns that adopt the heart-breaking policy of stagnation—which, when business prospers, are averse to any improvements because their prosperity makes it unnecessary, and in times of depression decline to consider new ideas on the score of expense.

During the last few years the question of placing Home and Colonial orders out of the country has received its share of attention. Most right-minded manufacturers consider that their friends in the Dominions should always have the good sense to place their orders in the Home country, and Ruskin could possibly have proved this to be to the economic advantage of the Empire; it would take more than Ruskin to explain away the large price difference that at times sends these orders elsewhere, especially when the recipient may be paying higher wages.

Municipalities are often looked upon as moral perverts, and generally contemptible, if they place their orders abroad; but surely, so far as the affected industry is concerned, it should be a case of self-examination, rather than the examination of others. The attitude of industry in such circumstances seems much like that of the bar politician who, while claiming to hold the solution of all national difficulties, makes a sad mess of domestic problems in his own home.

Industry should look to itself for help, and courageously sweep away its present jog-trot lackadaisical methods, which cheap power, labour, or anything else will never make up for.

The information given in this article does not belong to the few; it is common knowledge. Almost every week articles and books are published, purporting to explain the secret of industrial prosperity and high wages, and by this time it should be a secret no longer.

These works have been approached from several points of view, but the consensus of opinion appears to be that productivity is at the root of industrial prosperity, and that efficient co-operation of workers, and organisation, are the fundamentals of productivity.

The reader might be forgiven for thinking this the end of the matter, but it is of no avail how many times the fact is proved on paper—no real value will result until it is put into practice.

Nobody would suggest that British industry was or ever will be dead, but it certainly is not prosperous at present, and it is felt that proper reorganisation would do more than anything else to win back the place in the sun which has become a national right.

The Electric Lighting of the Cathedral of St. Sophia, London.

An extensive scheme of decoration and repairs has recently been completed at the Greek Cathedral of St. Sophia, in Moscow Road, Bayswater, introducing some novel features in church decoration. The building was erected in the later part of the last century, but the internal decoration had been left incomplete. It was decided by the Greek community to complete the decoration, and at the same time to install a system of electric lighting. Mr. H. O. Corfiato, S.A.D.G., architect, was entrusted with the preparation of a scheme, Messrs. Lucas & Pyke, of Westminster, acting as consulting engineers for the electrical installation.

It was originally intended to decorate the whole of the interior of the Cathedral with mosaic, and portions of the work had already been done, but it was found that the large surfaces of mosaic caused serious defects in the acoustic properties of the building. Unaccompanied singing forms an important part of the Greek rite, and it was for this reason felt to be essential to correct, as far as possible, any acoustical shortcomings. It was therefore decided to carry out the unfinished portions of the decoration with a material sufficiently absorbent of sound waves to reduce the period of reverberation.

The material adopted, known as acoustic plaster, is a patented preparation made by the May Construction Company. It has the advantage of possessing a very high coefficient of absorption whilst differing very little in appearance or in practical use from ordinary plaster. The architect applied Prof. Labines's formula in order to find the necessary area of absorbent material. The Cathedral being in the Byzantine style, the new plaster decoration was designed in the manner of the painted and embossed cement which was used in some portions of the Church of St. Sophia at Constantinople.

The hieron, which corresponds to the sanctuary of an English church, presented a somewhat difficult problem. It is traditional to decorate this portion of a Greek church almost entirely with gold mosaic, but this being inadmissible it was decided to use a plaster surface, gilded with gold leaf; to avoid the dead appearance of a perfectly flat surface, the plaster was scored over with a circular motion of the tool when working, a method which has been traditional with plasterers from the earliest times. Some new mural paintings were executed in the hieron by Mr. Glyn Jones and Mr. Warren Wilson, A.R.C.A.

The Cathedral was cleaned thoroughly throughout and put into a state of repair, the contractors for this work being Messrs. Campbell, Smith & Co., Ltd., London.

The electric lighting scheme, prepared by Messrs.

Lucas & Pyke, in consultation with the architect, was designed to overcome a difficulty which arises constantly in church lighting. Churches being very commonly designed in the style of an early period when the oil lamp or candle was the only means of lighting available, it is impossible to devise any direct lighting fitting in harmony with the style of the building which will give anything like adequate illumination. Moreover, false candles or electroliers in imitation of candelabra are in the nature of a sham, and quite unworthy of a sacred edifice. For these reasons it was felt that a system of lighting approximating as nearly as possible to daylight conditions, in which the sources of light should be invisible, would be most suitable. After a careful study of the style of architecture generally and of the treatment of the walls and ceilings in particular, the consulting engineers produced a scheme of illumination embodying these requirements. The building is particularly adaptable for this method of lighting in that there is a large cornice around the base of the dome, which was found to be sufficiently broad to allow of the installation of powerful lamps and of reflecting surfaces so that the light from the lamps could be thrown upwards on to the gold mosaic work of the dome, and be thence reflected into the main body of the Cathedral. It was further decided to illuminate the hieron by means of flood-lights fixed at the back of the screen, so that the lamps would light the upper part of the niches, and the whole of the Cathedral (with the exception of the reading desks, desks in the choir gallery, &c.) should depend on the dome and hieron for illumination. But in order to be able to obtain special effects on the occasions of festivals, it was decided to introduce some method of controlling the illumination so that the intensity of the light could be raised or lowered at will. This object was effected by the installation of an induction regulator, which provides for a variation of voltage from 120 to 200 volts. The contractor was Mr. F. H. Wheeler, Westminster, to whom the whole of the installation was entrusted.

The dome lighting is effected by means of 72 300-watt lamps placed horizontally at regular intervals in front of a line of mirror-glass reflecting surface, fixed on the flat top of the cornice and around the base of the dome at the back of the cornice. These lamps are arranged in 12 battens holding six lamps each, and access is obtained to the battens for the replacement of lamps, cleaning purposes, &c., by means of a special arrangement whereby each batten can be lifted to the window above it by a man standing on the outside of the dome. The whole of the material for the dome lighting was supplied and manufactured by the British Thomson-Houston Co., Ltd., of Rugby. The hieron is illuminated under the centre arch by means of an angle-type reflector containing a 300-watt lamp, and the two outer arches are similarly illuminated by angle-type reflectors containing 200-watt lamps; these, as in the case of the dome fittings, were supplied by the British Thomson-Houston Co., Ltd. The strangers' gallery is illuminated by means of hidden reflectors containing 60-watt vacuum-type lamps, and the light therein, as in the dome and hieron, is controlled by the induction regulator, which was supplied by Messrs. Switchgear and Cowans, Ltd.

The Power Supply of Wireless Sets.

The Source-of-High-Voltage Problem.

By A. E. IRWIN.

THERE is little doubt that after the initial cost of a wireless broadcast receiving set, the heaviest item of expenditure is the maintenance of a h.p. supply, or valve-plate voltage.

At first sight, the purchase price of h.p. accumulator cells, or apparatus for obtaining a supply from the domestic electricity mains, appears to be an exhorbitant one. When compared over quite a short period, however, the enormous expense of a h.p. battery of dry cells becomes conclusive, and the initial outlay on either of the other methods is more than justified. Should electric light not be laid on in the user's house, h.p. accumulator cells are, of course, the only alternative. The curve in fig. 1 (recharges indicated by dotted lines) shows that a new battery of dry cells will have to be acquired some weeks before three months have elapsed, or when zero voltage is reached. The h.p. battery's final duty is usually that of loading up the power valve's anode voltage, and for this reason it is assumed to be of practical use right up to the point of complete exhaustion.

Working on the basis that the receiving set is in use for three hours on six days a week and six hours on Sundays, a weekly total of 24 hours, a good h.p. battery of dry cells of 100 volts, which costs about 25s., does not last more than three months at the most. Taking the same number of hours per week and an equal amperage demand, a domestic mains supply will amount in three months to about one kWh (up to 250 volts); the average price per kWh can be taken as 6d. Similarly, h.p. accumulator cells will last about one month before requiring to be re-charged, and the maximum price for recharging will be 2s., *i.e.*, 6s. for three months. If these maintenance costs are tabulated for a period of twelve months, the comparison will overwhelmingly favour the scrapping of h.p. dry batteries.

TABLE I.—MAINTENANCE COSTS PER ANNUM.

H.p. battery.	H.p. accumulator.	H.p.. supply from mains.
25s. × 4	6s. × 4	6d. × 4
£5	£1 4s.	2s.

Table I and fig. 2 show clearly that the first cost of h.p. accumulator cells (say, £5) is regained in just over 15 months, and thereafter an annual saving is made of £3 16s. In the case of a d.c. supply (cost of apparatus about £5), the first cost will be regained in about 12 months, and in that of an a.c. supply (cost of apparatus about £9) in one year and nine months; with either system £4 18s. will be saved per annum after the apparatus is once installed.

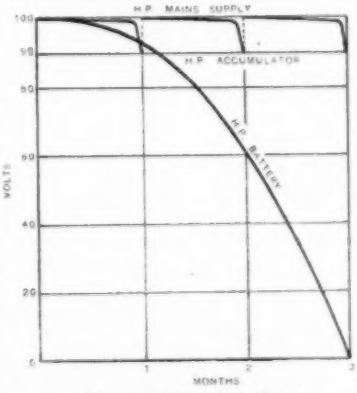


Fig. 1.—Time-Voltage Curves.

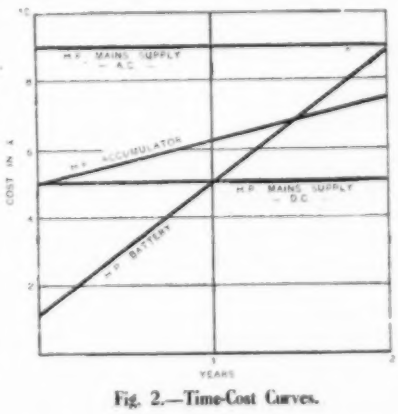


Fig. 2.—Time-Cost Curves.

The results obtained from any wireless set, provided

that the low-pressure battery of cells is kept properly charged, is directly dependent upon the h.p. supply, and the curves in fig. 1 may, therefore, be taken as a guide to the results to be expected over a period of three months. The inherent deficiencies of a h.p. dry battery, such as crackling noises, &c., are too well known to the listener to be enumerated here; one very great disadvantage of the dry battery is that a gradually decreasing voltage has to be compensated for, if fairly normal results are to be obtained, by an ever-increasing use of "reaction." This causes distortion in the receiver, and naturally interferes with neighbours' sets.

The curves in figs. 1 and 2 were prepared from the results obtained from a typical three-valve set; they clearly demonstrate that the supply from the domestic electricity mains is closest to the ideal, its only disadvantage being a temporary capital outlay. The use of h.p. accumulator cells is a good second, and even when the battery is in a run-down condition, it is somewhere in the region of 90 volts; this also has the temporary disadvantage of the former. The curves of the h.p. dry battery show that, whilst having the advantage of a low first cost, in the long run its use is an uneconomical proposition from the points of view of both expense and performance.

Uphill—All the Way.

By F. E. SCHOFIELD, A.M.I.E.E.

It is interesting to note that the dominant factor in the recent after-dinner speeches of the oversea premiers was inter-trade. For years we have become hardened to the constant suggestion that the home trade with the Colonies should be increased and nurtured, and I am afraid some of us had begun to doubt whether the Colonies were as keen on the home-produced article as certain wise men would have us believe. It is all the more interesting, therefore, to hear the view pronounced in our midst, in fact, in the heart of London itself, by the Colonial prime ministers themselves. This declaration gives added weight and significance to the matter, and will, I venture to think, result in a re-opening of the whole subject in the minds of many business men.

There is one very vital point, however, which must not be overlooked, and that is the necessity on our part of producing an article of the right kind and at the right price, for our Colonies are peopled by shrewd keen-witted young men who are not weighted down by a load of conservatism and convention, and therefore are quite able to sift the wheat from the chaff. It is not sufficient, therefore, to label our products "made in England" and leave the rest to loyalty. We know now that, given the chance, they will willingly purchase British goods in preference to any other, but these goods must stand in the open market side by side with the manufactures of the Americans, the Germans, and others. The scale may be weighted in our favour by the bond of blood brotherhood, but it is not sufficiently weighted to cover up inefficient design, obsolete ideas, ignorance of local conditions, and lack of knowledge of Colonial requirements.

It is useless for us to say "this is our standard so-and-so; it performs well here in this country and therefore it must be right for your country also." We must utilise our ideas and our brains to produce a British-built article specially designed and constructed to suit Colonial conditions. Some of our pet schemes may have to go by the board, but the experience gained in the overseas markets will more than outweigh the loss to our personal pride.

When Henry Ford designed his car he had in mind supplying the markets of the world with a reliable motor vehicle which would meet the requirements of the plain user. His scheme could never have been successful had he confined his attention to the American market only. It required the experience gained in almost every country of the world to perfect the Ford car, and in consequence up to recent times this car was supreme in South Africa and the other Colonies as a rough hack or runabout, owing to its utility and its ability to run for long periods with a minimum of skilled attention. Henry Ford was successful because he had realised that to be of real value under exceptional conditions, fewness of parts and simplification of detail were of greater importance than symmetrical outline and comfort.

Times are changing and our viewpoint has broadened since the war, so that we can now visualise the problem in its correct perspective. In the motor-car engineering profession we have not only demonstrated that we can produce cars that will withstand Colonial conditions and compete on equal terms with the American product, but we have carried the war into the enemy's camp and adopted his production methods to his own discomfiture. Even in the realms of electrical engineering, our makers of large-size generating plant and heavy-duty high-rupturing switchgear have shown that they have little to learn from over the water. The problem which has to be faced concerns the general run of industrial electrical plant down to the actual consumer and his fittings and appliances. This is a wide field, and one which possesses great possibilities if tackled in the right spirit. There are many concerns in the field, but with the majority the will to commence seems still to be lacking.

By this I do not mean that the English manufacturer is neglectful of or indifferent to the Colonial market, but having found a good outlet for the sale of his goods, he is apt to let the opportunity slip past him if he finds that Colonial conditions necessitate a revision or an alteration of his stock English design.

There is also another factor which at the present weighs heavily against us, and that is the unnecessary grandmotherliness displayed by certain of the Government departments where electricity is concerned. One only needs to travel on the Continent through Germany or Switzerland, or even in the United States, to realise how simple, and in some instances childishly so, are the regulations governing the use of electricity in those countries, compared with those obtaining here. Some three or four years ago I spent some time investigating switchgear in Germany and Czecho-Slovakia, and was very surprised to find this apparent indifference to safeguards against accidental contact on the ordinary forms of commercial control gear. I quite agree that the protection afforded by our standard Home Office designs gives a sense of security lacking in the Continental gear, but when one considers the oversea markets, one very quickly realises the advantage accorded to the foreigner by his cheaper and simplier construction. Whilst the conditions in our Colonies are nothing like so lax as on the Continent, there is in operation in all except the large towns and cities a simpler standard. In consequence, American and German gear which would not be allowed in this country is advertised and offered for use in the Colonies. Every care is taken abroad to safeguard the plant in the event of a fault occurring, but the same care is not taken to safeguard the ordinary user. And yet very few casualties are heard of abroad among the ordinary consumers, because the average user learns to appreciate the dangers and takes what he considers reasonable precautions himself.

This all points to the fact that the manufacturers generally must obtain inside knowledge, either from personal investigation on the spot, or through the good offices of a reliable and qualified agent on site, of the actual conditions obtaining in the Colonies, and of the

general methods of meeting such conditions adopted by the manufacturers of one's own country and those of other countries. Armed with this information, the designer can forge ahead and produce his Colonial designs based on the information received, backed by his own experience and inventiveness. In this way we can meet the foreigner on his own ground, and given this opportunity I do not doubt for one moment that our natural British supremacy will quickly become evident in this field also.

We must put our shoulder to the wheel, but lest anyone may think the task an easy one, let me again remind him it is uphill—all the way!

Parliamentary News.

[By Our Special Parliamentary Correspondent.]

Re-assembly.—The House of Commons re-assembled on Tuesday, November 9th.

The Electricity Bill.—The report stage and third reading of this Bill were taken last week in the House of Commons. The proceedings are reported separately in this issue.

Danger from Overhead Wires.—On November 9th, Mr. DAY asked the Minister of Transport if he would state the number and names of authorities or companies owning electric tramcars within the Metropolitan area that derived their power from overhead wires; whether his attention had been drawn to the danger experienced by pedestrians owing to the breakage of uninsulated wires; whether any action was possible with a view to avoiding danger; and, if so, would he consider introducing legislation making it compulsory to prevent it.

Colonel ASHLEY said that there were twelve authorities or companies working tramways in the Metropolitan Police Area on the overhead trolley system, namely, Barking U.D.C., Bexley and Dartford Joint Committee, Croydon Corporation, East Ham Corporation, Erith U.D.C., Ilford U.D.C., London County Council, London United Tramways, Limited, Metropolitan Electric Tramways, Limited, South Metropolitan Electric Tramways & Lighting Company, Limited, Walthamstow U.D.C., and West Ham Corporation. The number of reported cases of injury caused by the falling of the overhead conductor wires of tramway systems in the Metropolitan Police Area was very small, and it would not seem from the reports received that legislative action was necessary. The duty of proper maintenance of such wires rested with the tramway authorities and he had no evidence of any general neglect of this duty.

Tramway Accidents.—On November 9th, Mr. CAMPBELL asked the Minister of Transport in how many cases, since January 1st, 1925, he had investigated tramway accidents which were in any way connected with the braking system of the vehicles; whether in any of those cases the braking systems were found to be defective; and whether he was satisfied that as a general rule the braking systems of tramcars were fully adequate for all purposes.

Colonel ASHLEY said that apart from a number of cases in which inquiries and recommendations had been made by correspondence, formal inquiries into six tramway accidents had been held by inspecting officers of railways during the period referred to. In one of these cases it was found that the accident was primarily due to an undetected flaw in the brake mechanism. He was advised that the braking systems in use on tramways were generally adequate for all purposes, provided, of course, that the mechanism was properly maintained and handled, and the regulations complied with.

Coal for Electricity Authorities.—On November 11th, Sir W. LANE MITCHELL asked the Secretary for Mines if he would arrange for all imported coal to go to public authorities, gas, electricity, and railway companies, and confine home-produced coal to domestic use at a fixed price.

Viscount CURZON, who replied, said that the Secretary for Mines would carefully consider the suggestion, but he saw great practical difficulties in its application.

Broadcasting.—On November 15th, the House went into Committee of Supply on the supplementary estimate of £295,000 required for the broadcasting service. Sir W. MITCHELL-THOMSON, Postmaster-General, dealt at length with the position of the new Corporation. On March 31st last there were 1,964,000 licences; on October 31st there were 2,097,000, and it was estimated that if trade revived there would be on March 31st next 2,200,000 licences. It was anticipated that the Corporation would receive in its first financial year £805,000, and if the listeners increased by another 200,000 in the following year, the Corporation would receive £866,000. The State would retain £159,000 this year; next year it would retain £245,000, and the year after £271,000. For the three months from January 1st next to March 31st, the Corporation would receive £183,000.

After some discussion and criticism, the estimate was agreed to.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

A Contractor's Garden.

Much has been written and many typewriter ribbons have been worn out about "Electricity in the Home," and we have even heard about "Electricity in the Contractor's Home," but little appears to have been said about "Electricity in the Contractor's Garden."

Now my garden is a contractor's garden, and apart from chasing slugs at night with a flash lamp and using a long-lead portable lamp to see to plant bulbs in the dark winter months, it has other electrical equipment.

The garden peas once planted, the birds are scared by rows of cable labels or tallies fluttering on string; likewise the runner beans have a framework of conduit erected over them and laced up with old v.i.r. cables, round which they will twine better than round any string or bean sticks.

The tennis court is fenced in with conduit, to which wire netting is fastened, and the net is kept strained with a small arc-lamp winch.

The potatoes when lifted are dried and stored in the small sacks in which the C.M.A. makers so kindly pack 400 yards of 1/.044 or 3/.039 and which hold 28 lb. of spuds nicely; even if the bag is branded XXX Cable Company, the spuds keep all right.

The non-returnable 3-ply drums now so generously presented to us with every 50 yd. of twin lead cable, are useful seats and save you from catching cold through squatting on the ground whilst surveying your handiwork, or are very useful for a squat table when playing halfpenny nap with a pack of cards also branded XXX Cable Co., whilst for flower-pot stands you just use the cardboard centres, fill them with concrete or earth, and give them a coat of paint.

During the summer, if we have one, you lengthen out the watering-can with a few feet of conduit, and also use up any odd lengths and pieces for flower and small tree stakes, whilst old enamelled-iron shades with a lump of clay in the hole make fine bird baths when set in the rockery.

Casing and capping, of course, will find a home among the trellis, and as flower sticks, whilst a combination of four round blocks on a soap box is more useful than a wheelbarrow, and a really nobby garden path is made of broken-up ceiling roses and switch bases; for variegated effects, put in a few broken-up black bases.

If you are a particularly tidy man, you will use up a cord absorber on the clothes line, so that it can be unhooked (using of course a fittings S hook) and be unobtrusive when not required.

Of course, when erecting a battery we always return the carboys, but if you have the ill luck to break one, the iron basket will make a top-hole incinerator for burning up garden rubbish, whilst for stopping leaks in the greenhouse roof, nothing equals joint-box compound.

Don't throw away old cast-iron cases of switches or starters, as they make fine foot scrapers, and the glass fronts of dist. boards will form miniature cold frames for bringing on small lots of seeds.

I think I have said enough now to show that your garden can be a permanent advertisement of your trade instead of hiding your lights under bushels after business hours.

Contractor.

Bristol, *November 11th*, 1926.

Electric Fires for the Home.

In your issue of November 5th, "Fireside" shows how completely, in his opinion, the gas engineers have outdistanced the electrical engineers in their treatment of the problems of domestic fires. May I add another point? Professor Parker Smith, in his recent paper at the I.E.E., told us he retained fireplace recesses so that his family could "sit round the fire." This apparently they cannot do, they sit in *front* of a fire! Whereas the gas (and even the coke and wood) people make circular radiators, with central flues, so that large rooms can be centrally heated and twice as many people enabled to "sit round the fire," the electrical engineers, with no flue to contend with, make flat-sided apparatus. Why is this? Neither at the British Industries Fair, nor the Smoke Abatement Exhibition, nor in your recent special number, could I find anything larger than a toaster which folks could really sit round! Surely the centre of a large space is the correct place for a stove, and both gas and coke circular stoves are a commonplace of everyday life.

R. A. Sheldon.

Birmingham, *November 10th*, 1926.

The B.E.S.A. Glossary.

As Professor Howe states, a Committee is now going into this question and the time is not opportune for a lengthy discussion. I would, however, like to ask one question with regard to Professor Howe's letter in your issue of November 5th, namely, what is the *objective* distinction between "Field Strength" and "Flux Density"?

C. L. Fortescue.

City & Guilds (Eng.) College, London,
November 10th, 1926.

An Electrical Exhibition in Melbourne, 1927.

It may interest British manufacturers of electrical equipment and appliances to know that the Electrical Federation of Victoria (Australia) proposes holding an all-electrical exhibition in Melbourne from September 10th to October 1st, 1927.

The exhibition will embrace all phases of the electrical industry, including engineering, domestic appliances, accessories and radio. The Melbourne Exhibition Building, with a floor space of approximately 100,000 square feet, has been booked for the occasion, and an attendance of at least 100,000 is confidently anticipated.

A glance at the Year Book will show what an important field Australia presents to the electrical manufacturer, the importations from Great Britain alone for the year ending June 30th, 1925, amounting to approximately £4,400,000.

Should any manufacturer, who is not represented in Australia, desire further information, please communicate with the Electrical Federation, Law Court Chambers, Queen Street, Melbourne, when full details will be forwarded.

The Electrical Federation (Victoria).
WALTER RICHARDS, *General Manager.*

Melbourne, *October 12th*, 1926.

The Tungstone Accumulator.

In your comments on my letter to you dated October 23rd, 1926, you apparently make the usual error of confounding capacity and efficiency.

Further, I may say that quite a number of all types of batteries suffer under the conditions stated, or why the necessity of a conditioning or equalising (over) charge at regular intervals? How can a number of the ordinary efficiency tests be "exactly" repeated, when one cannot even be "exactly" made?

J. McD. Burnett.

Market Harborough, *November 11th*, 1926.

[We did not confound capacity and efficiency; we do not see how these, one of which is a quantity and the other a ratio, can possibly be confused.

E. J. Wade, in his classic work on "Secondary Batteries," said (p. 189): "The electrical efficiency of a cell is the ratio of the ampere-hours or watt-hours given out on discharge to those required to effect its re-charge *and restore it to precisely the same condition as at first.* Without this last proviso, efficiency figures have little meaning, and are comparatively valueless." (The italics are the author's.)

The method of testing under consideration unquestionably failed to comply with Mr. Wade's proviso.—EDS. ELEC. REV.]

Electricity Supply in Liverpool.

I was very interested to read your account of Mr. P. J. Robinson's address to the Mersey and North Wales (Liverpool) Centre of the I.E.E.; from the report it appears that Mr. Robinson evidently had a say in designing and also in deciding on the position of the new extension.

I have had the pleasure of viewing the new extension, and I think that the general opinion expressed amongst engineers is that an excessive outlay of public money has been incurred on the buildings, which up to the time of my visit, I understood, had cost over £250,000. The present building will only house two 25,000-kW turbine sets; in view of the fact that Mr. Robinson refers to the station having a capacity of 100,000 kW, I can only conclude that a further large sum of money must be expended on the buildings, and it is common knowledge that if a further extension takes place the present public swimming baths must be demolished, and rebuilt on another site to enable this extension to be carried out—who knows what the total cost of the building will be? I was also amazed to find the elaborate buildings prepared for receiving transformers, and h.t. switchgear. Modern practice tends to prove that the outside type of transformers are highly satisfactory, thus obviating the necessity of expensive buildings, and to my mind it is a retrograde step.

From the accounts in the paper it appears to me that Mr. Robinson admits that Lister Drive is as inefficient as a new station built on a colliery site would have been. I also note that he refers to the great cost of cooling towers built on a colliery site. I should like to ask Mr. Robinson if the cooling towers built on a colliery site would have cost more than those erected at Lister Drive.

It is true that it appeared to be a very expensive proposition to lay two lines of piping for condensing purposes at the Otterspool site, but I am convinced, and I think my views are shared by many other engineers, that the new station should have been built on the banks of the Mersey. If those responsible for the designing of the station had considered the advisability of building it on the Sloyne, Birkenhead, they would have overcome the great difficulty experienced on the Liverpool side owing to the large rise and fall of the tide involving an outlay of £400,000. If they had adopted this course I am convinced that they would have succeeded in securing the whole of the Wirral Peninsula load. I have in mind the comedy of the Mersey and West Lancashire Electricity District scheme, which was promoted by Liverpool, but the powers that be evidently instructed Mr. Robinson and those associated with him to change their minds and advise the Committee to drop out of the scheme; thus we must wait for the passing of the 1926 Act to put a stop to the building of modern stations on a site like Lister Drive.

I note that Mr. Robinson quotes the figure of £20,600 as being the extra cost per annum of a riverside station on account of the capital expenditure of £400,000 for obtaining a satisfactory water supply. He quotes the rate of growth at 4,000 kW per annum. Suppose we examine this figure and apply it to the present load of Lister Drive; we find that the following saving would have been effected had the station been erected on a riverside site:—

To-day's load factor is 31 per cent., with a maximum load of 73,000 kW, and I believe the Department uses about 250,000 tons of coal per annum. It is admitted that it would cost 10 per cent. less for fuel with a riverside station; therefore, if we take the price of coal at 20s. per ton, this would effect a saving of £25,000 per annum on their present load and probably at least £30,000 five years hence.

It is noticeable that Mr. Robinson does not quote this saving in favour of a riverside site.

The buildings at Lister Drive are severely criticised by many engineers who have visited the station. I suppose a first-class modern steel building filled in with bricks and white-tiled could have been built for £50,000.

N. H.

Ainsdale, *November 8th*, 1926.

The British Broadcasting Corporation.

Its Charter of Incorporation—Winding up the Existing Company.

Two Parliamentary White Papers issued last week provide for the forthcoming change in the broadcast radio-telephone service, to facilitate the continuance of which during the transition period the Postmaster-General submitted supplementary financial estimates to the House of Commons on November 11th. Both documents are abstracted below:—

The P.M.G.—B.B. Co. Agreement.

An agreement* dated November 9th, 1926, between the Postmaster-General and the British Broadcasting Co., Ltd., provides for the transfer of the latter's service to the British Broadcasting Corporation (Inc.). Subject to the necessary funds being provided by Parliament, the P.M.G. agrees to pay the Company £620,000, of which sum £548,464 represents the agreed payment to the Company's revenue in respect of the period from March 31st to December 31st, 1926, £71,536 being in respect of the share capital to be repaid in full, in full settlement of all claims against the P.M.G. under the agreements of January and October, 1923. In consideration thereof the Company will deliver on January 1st, 1927, all its stations, plant, &c.; the copyright in the *Radio Times* and *World Radio*, and the residue of its assets, after discharging its liabilities and providing for the repayment to its shareholders in cash at par of the amount of the subscribed and paid-up capital of the Company with dividends at the rate of 7½ per centum per annum accruing thereto as on December 31st, 1926, and providing for the expenses of and incidental to the liquidation of the Company. The Company, having for the purposes of its business entered into various contracts of a continuing character, shall assign to the Postmaster-General the benefit of all such contracts.

The New B.B. Corporation.

The draft Royal Charter† provides that the Earl of Clarendon, chairman, Baron Gainford of Headlam, vice-chairman, Sir J. G. Nairne, Bt., Dr. M. J. Rendall, M.A., LL.D., Mrs. Ethel Snowden, and all other persons who may become members, shall be the governors of the British Broadcasting Corporation for 10 years from January 1st, 1927. Its objects, amongst others, are: (*a*) to acquire from the P.M.G. licences from time to time for the erection, establishment, maintenance and operation within Great Britain and Northern Ireland, the Channel Islands, and the Isle of Man, of stations as a public utility service for broadcasting to the public by means of wireless-telephony; and to develop the service as may for the time being be permitted by the Postmaster-General. (*b*) To acquire, erect, equip and install stations with such machinery and other effects as may be requisite or convenient. (*c*) To compile and prepare, print, publish, issue, circulate and distribute, whether gratis or otherwise, periodicals, books, circulars and other literary matter. (*d*) To collect news of and information relating to current events in any part of the world and in any manner, and to establish and subscribe to news-agencies. (*e*) To acquire by registration, purchase, or otherwise, copyrights in any literary, musical and artistic works, and other matter, trade-marks and names, and letters patent or patent rights. (*f*) To establish and support or aid associa-

* H.M. Stationery Office, Cmd. 2,755; price 2d. net.
† H.M. Stationery Office, Cmd. 2,756; price 6d. net.

tions, institutions, funds, trusts and conveniences calculated to benefit employés of the Corporation, or the dependants or connections of such persons, and to grant pensions and allowances; and to subscribe or guarantee money for charitable objects, for any exhibition, or for any useful object. (*g*) To purchase, or otherwise acquire, real and personal property and rights or privileges which the Corporation may think necessary or convenient for the purposes of its business or the furtherance of its objects, and in particular any land, buildings, easements, machinery, plant and stock-in-trade. (*h*) To invest and deal with the moneys of the Corporation not immediately required in such manner as may from time to time be determined. (*i*) To borrow or raise or secure the payment of money, provided that the aggregate amount at any one time shall not exceed £500,000.

The Corporation shall not seek any concession, right, or enter into any negotiations with any Dominion or Foreign Government without having first obtained the consent of the Postmaster-General. The first chairman and vice-chairman of the Corporation shall hold office as long as they continue to be governors. The chief executive officer shall be the director-general, Mr. John Charles Walsham Reith.

The Corporation may appoint Committees to advise it with regard to all matters. The first governors shall remain in office for five years, and their number may from time to time be increased. Their remuneration must not exceed: to the chairman £3,000 per annum; to the vice-chairman £1,000 per annum; to each of the other governors £700 per annum, and they may in addition retain out of the revenue of the Corporation expenses properly incurred by them.

In the event of the Corporation borrowing money it shall accumulate a sinking fund towards the repayment of such moneys and to meet depreciation or contingencies, and also may set aside a reserve fund for other purposes than those provided for by the sinking fund.

The P.M.G.-Corporation Agreement.

The draft licence and agreement between the P.M.G. and the Corporation for 10 years stipulates that the latter shall not receive money or other consideration in respect of broadcasting without the permission of the P.M.G. other than for broadcasting the names of publishers and prices of matter which is broadcast. When requested, it shall broadcast any matter any Government Department may require; the P.M.G. may prohibit any matter being broadcast, and he may inspect and supervise any stations. The Corporation's use of the Post Office telephone system and trunk lines shall be on the same terms as an ordinary subscriber. It shall pay to the P.M.G. a royalty of £10 per annum in respect of each of the stations. The Postmaster-General shall pay to the Corporation in respect of every year of the term a sum equal to the following percentages of all sums received by him from his licensees: (*a*) In respect of the first million licences or fractional part thereof issued against payment in the year 90 per cent. (*b*) In respect of the second million licences or fractional part thereof issued against payment in the year 80 per cent. (*c*) In respect of the third million licences or fractional part thereof issued against payment in the year 70 per cent. (*d*) In respect of all additional licences issued against payment in the year 60 per cent. A deduction of 12½ per cent. on account of the cost of collection and administration shall be made from the amount of all sums received by the Postmaster-General in respect of licences before the calculation of the percentages referred to above.

The Postmaster-General undertakes to consider any application which may be made to him by the Corporation after January 1st, 1929, for an increase in the amount of the sum payable; the Postmaster-General shall not be under any obligation to take any action to recover payment of any fees in respect of licences.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Our Advertising Competition.—We have pleasure in announcing that the following gentlemen have kindly consented to act as judges in our Second Advertising Competition, of which particulars have already been published on several occasions and will be found in the present issue:—

Mr. J. W. Beauchamp, Director of the British Electrical Development Association.
Mr. W. F. T. Pinkney, Engineer, Lighting and Heating Department, Newcastle-upon-Tyne Electric Supply Co., Ltd.
Mr. H. T. Young, of Messrs. Troughton & Young.

Advertisers and their representatives who have not yet entered for this competition are urged to apply for entry forms as soon as possible.

The E.D.A.-E.L.M.A. Campaign.—The E.D.A. Press bulletin for the week ended November 13th states that additional circles have been formed at Brighton, Portsmouth, Basingstoke, and Kidderminster. Demonstration all-electric homes were opened at Paisley, Lincoln and Birmingham. The Walsall circle is arranging to run two demonstration homes, while another is to be opened at Nottingham. Since the issue of No. 4 of the "Home Lighting News" (see p. 834) the Association has sold 120,000 cheque-coupons. Orders have also been received for 90 model houses, 27 kinema slides, and 949 new posters. Up to the date of the report 1,250,000 poster stamps had been purchased from the Association and the sales of the competition booklet continue to rise. A Southport contractor has printed and circulated a postcard drawing attention to the competition. The Lincoln demonstration home was opened by the Mayor on Saturday last; the cost up to the time of opening was £30. Local contractors are rendering assistance in the arrangement of a house at Harrogate which it is hoped to open on December 6th. About a thousand people have visited the Edinburgh house (pictured below) daily, and it has been found possible to cease to advertise it. At Greenock a monthly social has been arranged to bring the various sections together. The Dundee demonstration house is to be opened to-morrow (Saturday), and three houses are to be proceeded with at Glasgow early in the New Year. Liverpool is already running a demonstration house and hopes to open another early next year, by which time it is also hoped to have a house running at Birkenhead. Arrangements are being made for the exhibition of models of the prize home in the windows of a number of large Liverpool stores. It is suggested that the competition

Dining Room. Drawing Room. Kitchen.

An All-Electric House at Edinburgh.

booklet sent to their customers by contractors would form an acceptable substitute for the stereotyped form of Christmas greeting.

As we reported in our last issue, an all-electric home was opened to the public in Edinburgh recently. We are now able to reproduce three views of the interior of the building which has been equipped jointly by the Electricity Department, representatives of manufacturers and wholesalers, and the Edinburgh branch of the Electrical Contractors' Association of Scotland. The house is similar to a number which are being erected in various suburbs of the city.

It has been tastefully furnished by Messrs. Renton's, Ltd., Edinburgh, and a radio installation has been provided by Messrs. Spensers, Ltd., including a 4-valve cabinet set and examples of loud speakers of the picture and rose bowl types are fitted in appropriate rooms. The Post Office Telephone Department lent a telephone and there is a Corporation inquiry bureau attached to the house. The electrical fittings have been supplied by various local manufacturers and wholesale showrooms. The kitchen is fitted with a Corporation type cooker, a "Creda" 10-gal. wash boiler, a "Heatrae" kettle, a "Magnet" washing machine, a "B.T.-H." swivel fan, an "Inventum" water heater, and a "G.E.C." 2-kW fire. The bathroom has a "Morganite" wall-type radiator, a "Wardle" ceiling fitting, a shaving mirror and a "Lightfoot" towel rail. The bath is heated by a "G.E.C." 3-kW immersion heater which is situated in the linen press. Various types of up-to-date vacuum cleaners are on show, and there is a complete selection of electrical toilet appliances and a violet-ray outfit. Supply is provided by a "Tungar" battery charger. Catalogues containing a list of all the furnishings and electrical appliances on show are available to visitors. These show the price of each article and the running cost per hour.

No. 4 of the "Home Lighting News" was published last week. The keynote of this issue is "Contacts," *i.e.*, getting into touch with the public. Lukewarmness is condemned, and contractors and supply authorities are urged to keep up public interest and maintain an adequate supply of competition booklets. Among the methods put forward are the use of a simple "cheque-coupon" (a sample of which is enclosed with the paper) and the exhibition of the prize house lantern slide at local kinemas. The new poster is reproduced, as is also a "posterette" for tramcar fanlights. A record of the progress of the campaign gives details of new circles which have been formed, and of the electric demonstration homes which have been opened. It is said that the total cost of running the West Hartlepool demonstration house was only £10. The furnishing firm which assisted in the display is so pleased with the results that it has offered its services in any future effort of the kind.

All electrical contractors and dealers are not using the shop-window schemes, but there are many putting up effective shows of different kinds. An example of these is the window

A Well-Dressed Window at Birmingham.

arranged with "Siemens" lamps and fittings by Messrs. Walker Bros., of Birmingham. A view of this firm's shop is reproduced herewith.

Glasgow Electricity Committee recommends that £100 be granted towards the cost of the campaign in Glasgow.

An all-electric house was opened on November 9th at Paisley, and it will remain open for public inspection for three weeks. The Paisley local committee has been granted the use of the house by the Corporation, whose Electricity Department has equipped it with the latest appliances. There are "Cosmos" and "Creda" fires, "Tricity" cookers, "Premier" kettles, "Sadia" water heaters, "Cosmos" vacuum cleaners, &c., in the house, which is being visited daily by large numbers of people.

Large Peruvian Contract for Germany.—The Peruvian Government has awarded contracts to the Allgemeine Electricitäts Gesellschaft and the Bergmann Electricity Works, for the construction of a large hydro-electric power plant at Ranboraque, near Callao. The total cost is stated to be over £900,000.

The Ironmongers' Exhibition.—An Ironmongery, Hardware and Domestic Appliances Exhibition was opened at the Agricultural Hall, N., on Monday last. It remains open until to-morrow (Saturday).

Social Events.—The employés and friends of Messrs. Elliott Bros. (London), Ltd., held their annual social recently at the Borough Hall, Greenwich. Music was provided by the "Century Works Orchestra," led by Mr. R. O. Smith, and a concert was given by a number of artistes and the "Checquers Concert Party," under the direction of Mr. L. R. Chandler. Dancing took place in the small hall, accompanied by Mr. Jack Attwood's dance orchestra. The chairman of the company (Mr. W. O. Smith) was unable to be present, but the company included Sir Keith Elphinstone, and Messrs. L. W. Smith and A. W. Atkyns and friends.

The A.T.M. Orchestral Society, composed of employés of the Automatic Telephone Manufacturing Co., Ltd., gave its first public concert on October 26th at Picton Hall, Liverpool, when a programme of light music, interspersed with vocal items, was rendered to over 800 people. Under the musical director, Mr. C. Brandreth, the orchestra, numbering 34 performers, has reached a creditable state of proficiency.

A New Zealand Cable Contract.—With reference to the paragraph in our last issue (quoted from our Australian contemporary *Tenders*), Messrs. Wm. Geipel & Co. write stating that the note does not place a clear interpretation upon the matter. They say that, whilst they understand that the Auckland Electric Power Board did at first refuse a request on the part of the British contractor to sublet a portion of the contract, it ultimately sanctioned it; they have, in fact, for some months past been working upon and have just recently completed a portion of the contract.

Hire-Purchase in Germany.—In a special *Financial Times* article it is stated that the hire-purchase system has made great strides in Germany. Special banks have been formed to finance this type of business, mostly with foreign capital. Among the classes of goods to which the system is applied are vacuum cleaners and other electrical apparatus. Although American interests have taken the matter up, it is thought that the American system may not be applicable to Germany. Experience has shown that the percentage of defaults is rather high.

The Progress of the Electrical Machinery Industry.—In our last issue we made reference to a monograph prepared by the British Engineers' Association for the Preparatory Committee of the Economic Conference of the League of Nations. This shows that in spite of the depression which has affected our heavy industries since the war, the electrical industry has continued to progress. Alone in its class, the electrical machinery industry recorded higher exports in 1925 than in 1913, an increase of 23.6 per cent. in tonnage. The year 1923 was a comparatively bad one for the industry, for the exports were only 62.3 per cent. of the 1913 tonnage. Since then, however, there has been a continuous upward movement, and, we believe, in spite of the coal dispute, 1926 will not spoil this record. At the same time the imports of electrical machinery have fallen. Figures given in the monograph show that the total in 1913 was 11,600 tons; in the last four years it has varied between 4,200 and 4,500 tons. The returns are analysed to secure the value per ton of machinery and it is found that the export figure rose from £84 in 1913 to £243.82 in 1922, but it fell to £174.60 in 1925. The value per ton of imported electrical machinery rose from £116.03 in 1913 to £252.43 in 1925. Electrical machinery represented 3.9 per cent. of the tonnage and 6.7 per cent. of the value of machinery exports in 1913; in 1925 the respective proportions were 6.4 and 11.8 per cent. Among the many interesting sections of the monograph is one dealing with wage levels. This shows very clearly the unenviable position of workers in the engineering industry as compared with those in more favoured industries. In printing and bookbinding, for instance, the rise above the 1914 level has been from 107 to 117 per cent., and the wages in the woollen industry are from 80 to 90 per cent. in advance of those paid in 1914. In the engineering industry, however, skilled men are only receiving wages about 45 per cent. above those of 1914; the wages of labourers in the industry have, however, advanced by 76 per cent.

A Sturdy Iron.—The following is an extract from an electrical contractor's letter sent us by the Automatic Telephone Manufacturing Co., Ltd.:—"One of our clients went away on holidays for nine days, and on her return found that she had left the iron, which was an 'Xcel,' on circuit the whole time, and although the face of the iron was discoloured, the element did not burn out, and is still giving satisfaction."

Disposal of Power Plant. — The Portsmouth Tramways Committee has accepted the tender of the Midland Iron and Hardware Co., Ltd., at £3,353, for the whole of the steam and electrical plant at the tramway power station, Vivash Road, Fratton. As the tramways are now supplied with energy by the Corporation Electricity Committee, the plant is no longer required.

Co-Partnership in Industry.—A luncheon was held by the Labour Co-partnership Association last week, when Mr. W. Cash gave an address on "Statutory Co-Partnership." The speaker dealt with a number of schemes which had received legislative sanction in such industries as gas and electricity supply, and considered that when the larger questions had been dealt with, something of the kind might be applied in the mining industry. Subsequent speakers expressed approval of the suggestion.

Unemployment.—There was an increase of over 43,000 in the unemployment total during the week ended November 1st. The number at that date was 1,559,200, as compared with 1,516,171 on October 25th and 1,207,612 on November 2nd, 1925.

Hebden Bridge and Local Contractors.—In the opening of the Hebden Bridge District Council's new electrical showrooms, Mr. H. H. Sutcliffe, the electrical engineer, has come to an amicable agreement with local electrical dealers. The Council has no power to sell electrical equipment but can act as agent and it is on these lines that the arrangement has been reached with the local contractors. The Council is arranging to let out cookers, wash boilers, &c., on hire. The rear room of the building is to be fitted as a permanent exhibition room for cookers and washers. Three rooms are fitted as sitting room, bedroom and kitchen respectively, and the old office becomes an electric bathroom.

Postmark Advertisements Abandoned.—It was announced last week by the Postmaster-General that he had decided not to proceed with the scheme for allowing private advertisements to be used as postmarks.

Power Plant and Tramways for Angola.—*Commerce Reports* states that the municipal authorities of Loanda, Angola, have invited tenders for the concession providing for the construction and operation of an electric power plant and a street railway system in the town. Specifications have been issued, and tenders must be sent in by February 7th, 1927.

Change of Address.—The registered offices and laboratory of the British Cast Iron Research Association are now at 24, St. Paul's Square, Birmingham. Telegrams: "Cira, Birmingham"; telephone: Central 1885.

Trade Announcements.—MR. WALLACE H. WINCHCOMBE, radio engineer, has opened business premises at 160, County Road, Swindon, Wilts.

THE UNITED ELECTRICAL CO. (BIRMINGHAM), LTD., is manufacturing "Coolex" fuseboards at new works that it has opened in Caroline Street, St. Paul's Square, Birmingham.

MR. MONTAGUE COOPER, radio engineer, of 60, East Street, Taunton, is retiring from business at Christmas, as the premises are required by the owner.

With reference to the announcement appearing in our issue of October 22nd, p. 687, concerning the appointment of their North of England representative, MESSRS. ELECTRICAL UTILITIES, LTD., now state that Mr. G. Ellam, of 37, Cannon Street, Manchester, is still their agent for heating and cooking goods, as before, in the county of Lancashire, &c.

The new proprietors of SOMERSET MOTORS, 1926, Corporation Street, Taunton, announce that they are closing their wireless department.

MESSRS. WALTER DIXON & Co., consulting engineers, Glasgow, state that the place of the late Mr. Walter Dixon in the firm has been taken by his son, Mr. Arthur Dixon, B.Sc. The firm name is retained.

MESSRS. KEMP'S MILLS, LTD., Wolverhampton, manufacturers of wireless apparatus, are opening works at Kirkcaldy, and employment for over 300 people is expected to be provided.

THE MULLARD WIRELESS SERVICE CO., LTD., has opened a depôt at Corn Exchange Buildings, Burgh Quay, Dublin, in charge of Mr. J. Atkinson.

Catalogues and Lists.—THE HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, E.15.—A large coloured poster (approximately 5 ft. by 3½ ft.) advertising "Hart" batteries for automobiles and radio work. A folder containing particulars of "Hart" batteries for various types of generating sets.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Folder O.S. 4232, containing details and prices of "Osram" automobile lamps.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—A priced folder advertising "Argenta" opal gasfilled lamps, with space for dealers' names and addresses.

MESSRS. W. SANDERS & Co., Falcon Electrical Works, Preston.—An illustrated and priced catalogue of ironclad switch and fuse-gear.

HOPKINSON INDUCTION MOTORS, Willesden Lane, North Acton, W.3.—November stock list of a.c. motors.

MESSRS. HERBERT MORRIS, LTD., Loughborough.—Book 113, dealing with goods-handling slings, &c.

HOLOPHANE, LTD., Elverton Street, Vincent Square, S.W.1.—An illustrated booklet describing the company's stage-lighting equipment, which is shown at a miniature theatre at the above address.

MR. JOHN KIRBY, 16, Shortridge Terrace, Jesmond, Newcastle-on-Tyne.—Illustrated pamphlets dealing with organ-blowing equipment.

THE MALDON ELECTRIC WORKS, LTD., 4, South Street, Finsbury, E.C.2.—A catalogue of small electric motors and electrically-driven tools.

MESSRS. E. BROOK, LTD., Empress Works, Huddersfield.—Pamphlet No. 145, advertising the company's motors.

THE CARRINGTON MANUFACTURING CO., LTD., 18-20, Norman's Buildings, Central Street, E.C.1.—An illustrated catalogue of cabinets for radio receiving sets, &c. Special types are catered for.

THE THERMOPATH CO., LTD., Albion House, 59, New Oxford Street, W.C.—An illustrated pamphlet dealing with "Meracol" electric heaters. Priced.

THE MORGAN CRUCIBLE CO., LTD., Battersea Works, Church Road, S.W.11.—A priced and illustrated catalogue of "Morganite" non-metallic electric heaters.

MESSRS. NEWTON & WRIGHT, LTD., 471-3, Hornsey Road, N.19.—A supplementary abridged list of apparatus for radiology. Fully illustrated and priced.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—List No. 900, containing details and illustrations of many kinds of industrial, commercial and general lighting fittings. A great deal of technical data is included and prices are given.

Bankruptcy Proceedings.—G. BOYD, New Road, Mouse Hill, Milford, Surrey, electrical engineer.—The public examination of this debtor was held recently at the Guildhall, Guildford. The statement of affairs showed liabilities of £282, against assets of £31, leaving a deficiency of £251. It appeared that debtor commenced business on his own account in July, 1925, taking rooms at Milford. He had about £12 capital, and his business was mainly contracts for wiring and overhauling electric lighting installations. He continued trading until September 14th last. He attributed his failure to want of capital and bad trade owing to the coal dispute. The examination was adjourned to be closed.

A. P. PACIFICO, J. P. PACIFICO, and R. FEITELSON, lately trading as the Comton Wireless Manufacturing Co., 26-28, Bartholomew Square, Old Street, E.C.—The public examination of these debtors was held at the London Bankruptcy Court on November 10th, before Mr. Registrar Mellor. The accounts showed total liabilities of £3,239 (unsecured £2,552), and net assets valued at £1,725, after deducting £105 for payment of the preferential claims. According to the debtors' statements the business was started in January, 1923, by J. P. Pacifico and R. Feitelson, at Old Comton Street, W., under the style of the "Comton Wireless Co.," the capital of £50 being provided by Feitelson. They were successful, and in March, 1924, were joined by A. P. Pacifico, and the business was removed to Bartholomew Square, E.C., and the style changed to its present form. The trading continued to be successful until about February, 1926, when it was adversely affected by a trade slump, and debtors subsequently traded at a loss. In March, 1926, with the object of obtaining additional capital to tide them over the period of the slump, and to develop the export side of the business, they endeavoured to obtain £3,000 in the form of investments in the business, but, owing to the general strike, intending investors withdrew before negotiations could be completed. Towards the end of May, 1926, creditors commenced to press for payment of outstanding accounts, and early in June execution was levied at the instance of two judgment creditors; the whole of their stock and effects was sold, and the business thereupon ceased. A meeting of creditors was held in June, just before the advertised date of the sale, when an offer of a composition of 5s. in the £ was declined, and they thereupon filed their petition. The debtors attributed their failure to the trade slump and heavy depreciation in the value of stock, to the general trade depression, and to other causes. The examination was concluded.

N. L. CRAWLEY, electrician, late of 90, Three Colt Street, Limehouse, E.—This debtor attended on November 10th, before Mr. Registrar Mellor, at the London Bankruptcy Court, for public examination upon accounts showing liabilities of £1,727, against assets valued at £121. In the course of his examination the debtor stated that in March, 1924, he borrowed £400 from his father and purchased a one-third share in the Eastern Wireless Co. One partner retired in June, 1924, and in the following December he (debtor) bought out the remaining partner for £80, and continued the business alone until April, 1926, when he sold it for £300, which he used in living and travelling expenses, and in discharging liabilities. He had since been without regular occupation. The debtor attributed his failure and insolvency to lack of business experience. The examination was concluded. The following are creditors:—

	£		£
Barclay's Bank, Ltd.	57	Hyatt & Co., Ltd.	29
British Trade Journal	63	Newton Distributors, Ltd. ...	25
Bonstead & Sons	46	Odhams Press Ltd	77
Bartlett, J., & Sons	27	Redferns Rubber Works, Ltd. ...	43
Crystalate Mfg. Co., Ltd. ...	21	Trehearne, Mrs. A. F. A. ..	300
Crawley, D.	900		

W. WHITE, Broad Lane, Whoberley, near Coventry, electrical supplies factor.—The public examination of this debtor was held recently at the County Hall, Coventry. The ranking liabilities were returned at £990, and there was a deficiency of £957. Debtor commenced business as a factor in electrical supplies in October, 1921. He had £100 capital, and borrowed a similar sum. It was intended that the lender should join him in partnership, but no agreement was actually entered into, and two months after the business commenced, the partner left, the £100 remaining unpaid. Debtor subsequently removed to various other addresses. Debtor said that he was in difficulties in 1922, and the Sheriff was in possession that year. The examination was adjourned.

A. J. WELLS, electrical engineer (lately carrying on business in partnership with W. Bashford as Wells & Co., electrical engineers), 52, Princess Street, Luton.—Receiving order made November 6th on debtor's own petition.

J. F. Carr, electrical goods agent, 89, Aston Avenue, Fallowfield, Manchester.—First and final dividend of 3½d. in the £, payable at the Official Receiver's office, Byrom Street, Manchester.

F. Anderson, 109, Warwick Street, Greenheys, Manchester, electrical engineer.—Receiving order made November 8th, on a creditor's petition.

A. F. Webb, Regent's Road, formerly 102, Duke Street, St. Helens, Lancs., electrician.—Last day for receipt of proofs for dividend, November 27th. Trustee, Mr. E. D. Symond, 11, Dale Street, Liverpool.

W. S. Miles, "Roslyn," Worstan Road, Burnham, Somerset, radio engineer.—First and final dividend of 2d. in the £, payable November 16th, at the Official Receiver's Office, 26, Baldwin Street, Bristol.

J. A. A. Bardsley, late of 91, Old Hall Street, Withington, Manchester, electrical contractor.—First and final dividend of 1s. 3½d. in the £, payable at the Official Receiver's Office, Byrom Street, Manchester.

C. E. Elliston, electrician, and Elsie Elliston, Fleetwood Road, Carleton. These debtors were examined at Blackpool Bankruptcy Court, on November 12th. Liabilities were £48, and there were no assets. The examination was adjourned.

Private Arrangements.—Stokes & Sellers, electrical engineers, 25, Garden Street, Bury.—A meeting of creditors was held recently at Bury, when the statement of affairs presented showed liabilities of £1,493, of which £1,295 was due to unsecured creditors and £198 to cash creditors. There was a deficiency of £665. It was stated that the cash creditors were friends and relatives. The business was commenced in January, 1925, with a joint capital of about £100. During the year to January 31st last the turnover was about £4,000, but there was a net loss on the trading of £417, of which each partner was debited with half, and up to June 30th last there was a further net loss of £48. Since June the turnover had been fairly substantial, but there was a loss of £270. At one time the gross profits were in the neighbourhood of 35 per cent., but they had fallen off, and latterly had been about 20 per cent. There were certain pressing creditors, and after discussing the position it was decided that a deed of assignment should be executed with Mr. W. Nuttall, C.A., Bury, as trustee, together with a committee of three of the principal creditors. The creditors include:—

	£		£
Pilkington & Co.	52	R. Johnson, Clapham & Morris...	52
Pilkington Tile Co., Ltd. ...	46	Stonebridge Foundry Co.	45
Giddings & Dacre	40	Baxendale & Co., Ltd.	41
Marsdens Tile Co.	43	E. Foster, Ltd.	90
R. Russell, Ltd.	71	W. E. Sadler	50

J. & B. Radio Supplies, 34, Oxford Street Chambers, Reading.—A meeting of creditors was held recently at Reading, when it was stated that a balance sheet was prepared last June which showed liabilities of £804, and a deficiency of £552. It was stated that the business was commenced by two partners in June, 1925. One did the travelling and the other attended to the accounts. The drawings had been at the rate of £2 a week each. The commencing capital was £70, and according to figures prepared last February, the firm was then solvent. One of the partners subsequently left the business, and the remaining partner stated that he was unable to give details as to how the deficiency of £551 had arisen between February and June of the present year. Dissatisfaction was expressed at the position disclosed, but it was eventually decided that the matter should be dealt with under a deed of assignment, with Mr. C. Latham, 78, New Oxford Street, W., as trustee, together with a committee consisting of Mr. W. A. J. Osborne, and the representatives of Metro-Vick Supplies, Ltd., and Messrs. Lamport, Gilbert & Co.

W. R. Jones, trading as Associated Wireless, 289a, King's Road, Chelsea, S.W.3, radio and electrical dealer.—A meeting of creditors was held on November 11th, when Mr. A. E. Hepburn stated that the debtor found it necessary to call his creditors together as he was unable to meet their accounts. The liabilities amounted to £854 and the assets as valued by the debtor totalled £278. The largest creditor was the debtor's brother for an amount of £509 advanced. The cash creditor had intimated that if the other creditors agreed to accept the debtor's assets to be distributed amongst them *pro rata* he would forego his claim. The book debts were of a somewhat doubtful nature; a former traveller of the debtor also owed £50, which he proposed paying back by instalments of £1 a week. From May 24th, 1922, the date the debtor commenced the business, to March, 1923, there was a loss of £451. For the following period to March, 1924, there was a profit of £194 and the debtor had drawn £122, while for the year to March, 1925, there was a further profit of £66, and the debtor had drawn £335. Against the amount drawn out, the debtor had during that year put into the business the sum of £400 odd. The average turnover was £1,700 per annum. The debtor said that he originally manufactured bulk crystal, but gradually the orders for this had decreased, and consequently he had to start manufacturing general factory goods and the profits were not so large. It was resolved that the estate should be dealt with under a deed of assignment in favour of Mr. Hepburn as trustee.

Dissolution of Partnership.—E. Sutton & Co., electrical engineers, contractors, inventors, and patentees, Northgate, Darlington.—Mrs. M. A. E. Lower and Mr. E. Sutton have dissolved partnership. Mr. Sutton will attend to debts and continue the business in his own name.

Company Liquidations.—Birmingham Radio and Engineering Co., Ltd.—A meeting of members is called for December 15th at the offices of Messrs. A. E. Sherrey, Garland & Co., 148, Edmund Street, Birmingham, to hear an account of the winding up from the liquidator, Mr. J. A. Garland.

Power & Lighting Supplies Co., Ltd.—A meeting of members is called for December 14th at 47, Mosley Street, Manchester, to hear an account of the winding up from the liquidator, Mr. A. T. Eaves.

Cox Cavendish Electrical Co., Ltd.—A meeting of members is called for December 7th at 3, Lincoln's Inn Fields, W.C., to hear an account of the winding up from the liquidator, Mr. A. Nisbet.

Middlesbrough Steel Tube & Conduit Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. H. Anderson, Zetland Road, Middlesbrough, appointed October 30th.

British & Overseas Engineering Syndicate, Ltd.—Meeting of members December 15th, at 4, Old Burlington Street, W.1, to hear an account of the winding up from the liquidator, Mr. J. Findlay.

Metro-Vick Australian Works Extension.—The Sydney *Labor Daily* reports that in order to cope with its contracts for railway switchgear for the electrification of the suburban railways and for electrical appliances for the Bunnerong Power House, the total contract price of which approximates £400,000, the Metropolitan Vickers Electrical Company, of Auburn, has commenced the erection of considerable extensions to its plant and factory which was erected last year. The additions will cost £50,000, including £40,000 worth of machinery from England. The building will be completed by Christmas, and it is anticipated that within two months of that time 200 additional men will be employed in the works. A railway siding from the main line is also to be run to the works. In addition to its Australian contracts, the company has received a substantial contract from New Zealand.

Lead.—Messrs. James Forster & Co., reporting on November 13th, stated:—"Considerable arrivals of lead from Australia are due this month, some of which will probably be put into warehouse. These exceptionally large arrivals are probably the stock in Australia which was to have been shipped in June, so that it is not likely that they will be repeated. Most of the Mexican lead, on the other hand, seems to be going to the Continent, where the demand, though quiet, is steady. It now remains to be seen whether the settlement of the coal strike will bring about a revival in demand in this country. A firmer market here would probably bring in consumers in America, where prices are marking time pending a definite movement one way or the other from this side." The Board of Trade returns for October show as follows:—Imports 23,320 tons, exports 1,249 tons, leaving for home absorption 22,071 tons.

Registered Contractors.—The following applications for membership were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its meeting on Noyember 12th:—

Little, F. R., Ashington, Northumberland.
Wardleworth, L. & V., Heaton Park, Manchester.
Crowther, H. T., South Shields.
Handley & Higgins, Knutsford.
Keay, G. F., Middleton Junction, Lancs.
Bland, L. G., Ware, Herts.
Mitchell, J. A., Kidderminster.
Sutcliffe, H., Chester.
Colley, Marriott & Co., Ltd., Liverpool.
Jones, J., & Co. (Nottingham), Ltd., Nottingham.

At the same meeting three applications were declined.

Irish Free State Electrical Imports.—The imports of electrical goods, excluding machinery, into the Irish Free State during September last amounted to £31,686, as compared with £39,594 in September, 1925. The official returns for the first nine months of the year show a total of £327,687, as compared with £249,032 in the corresponding period of 1925.

Italian Electrical Imports.—At a meeting between the Minister of Economy and the Fascist Confederation of Industry, representing twenty-one of the largest manufacturers of electrical machinery, the attention of the Government was drawn to the increasing imports of foreign goods, which rose from 35,000 quintals in 1923 and 1924 with a value of 55,000,000 lire to 51,000 quintals in 1925, valued at 97,000,000 lire; while, during the first seven months of 1926 they reached 38,000 quintals, valued at 76,000,000 lire. Signor Benni, speaking for the Confederation, declared that the position of Italian manufacturers was becoming increasingly difficult, and demanded assistance in the form of further customs duties on foreign importations.—*Reuter's Trade Service* (Rome).

The Timber Market.—Our Timber Trade correspondent reports that the timber market for North European and Canadian softwoods has firmed up in all directions during the past month, prices having advanced appreciably in view of the higher freight rates ruling, which are from 30s. to £2 a standard of 165 cubic feet more than those ruling before the coal strike. Imports of North of Europe softwoods have increased largely over the month; they are wanted, as stocks in the country are much lighter compared with a year ago, whilst the present fairly good consumption will increase when industry is again in its stride. Canadian wood imports are lighter, with a satisfactory demand on the whole. In all hard and fancy woods the market is also firming up, mahogany making good prices, with stocks small in first hands. The American varieties are in large stock, but for future business shippers are well up in their rates, and with freights also high spot values are likely to remain strong and steady.

Book Notices.—"Rotary and Motor Converters," by E. F. Smith. Pp. xii+233; figs. 57. Price 7s. 6d. net. "Electric Lighting, Starting, and Ignition for Motor-cars," by H. H. U. Cross. Fourth edition, enlarged. Pp. xliii+328; figs. 185. Price 15s. net. London: Crosby Lockwood & Son.

"Home Fires Without Smoke," by C. Elliott and M. Fitzgerald. Pp. xvi+58. London: Ernest Benn, Ltd. Price 3s. 6d. net.

"Polyphase Induction Motors," by R. D. Archibald. Pp. xii+88; figs. 46. London: Chapman & Hall, Ltd. Price 5s. net.

"Memoirs of the College of Engineering, Kyoto Imperial University." Vol. IV, No. 3, July, 1926.—Results obtained by the Schlumberger method of electrical prospecting.

"Quarterly International Study of Trade Conditions prepared by the Economic and Statistical Department of the British Electrical and Allied Manufacturers' Association." No. 1, December, 1926. Price 5s. net.

Advertising in the Engineering Industry.—A meeting of the Engineering Section of the Incorporated Society of British Advertisers will be held at the Midland Hotel, Manchester, at 2 p.m. on November 26th, for the discussion of direct mail advertising as it affects engineering firms. Members and others proposing to attend should communicate either with Mr. H. M. Goody, Brookhirst Switchgear, Ltd., Northgate Works, Chester, or Mr. A. W. Swan, Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick, W.4.

Proposed New Buenos Aires Subway.—The *Daily Telegraph* has been informed by Major O. Sumner that he has received cabled advice from Dr. Marco, president of the Argentine Bank of the Nation, that the plans, &c., submitted by Messrs. Sumner, Mayoh & Haley, Ltd., the Westminster engineers, for a complete system of underground tube railways for the city of Buenos Aires, on the lines of the latest London tubes, have been approved and adopted by the municipal council. The scheme was referred to in our last issue (p. 794).

A later report states that it is premature to say that the scheme has been approved, in view of the concession held by the Anglo-Argentine Tramways Co., Ltd.

Deed of Assignment.—J. M. B. OLIPHANT, E. R. WHITFORD, and C. C. JOHNSTON, trading as the Campbell Radio Co., 2, St. Catherine's Road, Southbourne, Bournemouth, dealers in radio apparatus.—Particulars of claims to be sent by December 9th to the trustee, Mr. P. S. Booth, 14-17, Holborn Viaduct, E.C.1.

Spanish Railway Electrification Contracts—*Commerce Reports* says that the electrification of, and erection of substations on, the Manresa-Barcelona Railway have been awarded to French companies. Swiss interests have received a contract for 22 electric locomotives and combined Anglo-American interests are to supply 26 motor cars and trailers.

The "Swiss interests" referred to are the Oerlikon Company, which informs us that the contract for 22 electric locomotives for heavy duty was secured in the face of keen competition on the part of the leading European and American locomotive builders. The Spanish Committee of Experts had before them the satisfactory results obtained with the Oerlikon locomotives in use on the Paris-Orleans railway system. The Spanish Northern Railway Company (Compañia de los Caminos de Hierro del Norte de España) operates a large system, and has now started to electrify the lines radiating from Barcelona; the first sections to be taken in hand are the Barcelona-Manresa line and the line to San Juan de las Abadesas in the Pyrenees. The system adopted is the same as that on the neighbouring French Midi Railway, *i.e.*, 1,500 volts d.c. overhead. The locomotives ordered are intended for hauling goods trains and for dealing with ordinary passenger traffic as well as express service. The trailing load will be 1,200 tons and the maximum speed 56 m.p.h. The locomotives are to be built for an output of 2,040 h.p. at about 20.5 m.p.h. This corresponds to a tractive effort of 16.7 tons one-hour rating and 12.3 tons continuous rating. The locomotives will be designed for regenerative braking for use during down-grade operation. The locomotives are carried by two six-wheel bogies coupled together. Each axle is driven by one motor, through reduction gear, with a ratio of 1 to 4.33, disposed on one side. The motor is arranged for "tram" suspension. The weight of the locomotive is 90 tons.

G.I.P. Railway Contract.—British Brown-Boveri, Ltd., has recently received an order for a high-speed electric locomotive in connection with the electrification of the Bombay-Igatpuri and Bombay-Poona sections of the Great Indian Peninsula Railway. The locomotive will be designed for d.c. at 1,400 volts. It will be of the 2-AAA-2 (4-6-4) type with three driving axles, and will embody the special system of flexible individual axle drive which has been developed by the company. This drive has been applied with success to 114 high-speed passenger locomotives, while it is also to be fitted to 28 locomotives being built by other manufacturers. The drive has been standardised, after most exhaustive tests, by the Swiss Federal Railways for all their high-speed passenger locomotives. The G.I.P. locomotive will have a one-hour rating of 2,450 h.p. at the motor shafts at a speed of 36 miles per hour, and will be designed for a maximum speed in service of 75 m.p.h. There will be six motors rigidly mounted on the locomotive frame and arranged in pairs geared through the flexible drive to the driving axles. The controller will be electro-pneumatically operated, and will be arranged to connect the motors in series, series-parallel or parallel, according to speed requirements.

Salvadorean Fair.—A section for electrical goods is being provided in connection with the First Internation Sample Fair, which is to be held in San Salvador from December 24th to January 8th next.

New B.T.-H. Premises.—In addition to the new showrooms and stores at Birmingham, of which we recently made mention, the British Thomson-Houston Co., Ltd., has opened similar premises at King Street West, Manchester, and Marston Road, Middlesbrough.

Sydney Lamp Contract.—The *Sydney Morning Herald* reports that at a meeting of the Sydney Electricity Committee last month it was decided to place an order with a Sydney firm for electric lamps of French manufacture. The manufacturers, it was stated, were not prepared to furnish any of their lamps to the Sydney agents. It was agreed to place a trial order with the agents provided that the manufacturers were agreeable to let the City Council's London agents inspect the lamps at the place of manufacture. Mr. Forbes Mackay, the manager of the City Electricity Department, was averse to the proposal, but those in favour of it said that they "wanted to smash the combine" which existed among British manufacturers.

For Sale.—The Midland Iron and Hardware Co., Ltd., of Cradley Heath, invites offers for steam and electrical plant lying at Portsmouth. The officer-in-charge, R.E. Stores, Colchester, invites offers for surplus War Department machinery, consisting of steam, gas, and petrol engines and electric generators, switchboards, &c., lying at the R.A.C. depôt, Weedon. Doncaster Board of Guardians invites offers for two 25-kW Browett-Lindley high-speed engines direct coupled to shunt-wound bi-polar generators, one 3-panel switchboard, spare armature and battery booster. (See our advertisement pages to-day.)

The F.B.I. and Coal.—The Federation of British Industries urges its members to prevent large rises in the price by an excessive demand for coal, upon the resumption of work by the miners, by limiting their demands as much as possible.

Swedish Enterprise in Rumania.—It is reported from Stockholm that the Swedish L.M. Ericsson Company proposes to form a subsidiary company for Rumania with the participation of Rumanian interests. The company would occupy itself with manufacturing operations and the construction of telephone exchanges and networks. A representative of the firm is said to have confirmed the statement that negotiations have been proceeding between the company and the Government, but no information is vouchsafed concerning the present position of the negotiations.

Indian Electrical Imports. — The value of the electrical equipment imported into India during August last is officially returned at 3,200,000 rupees, as compared with 2,695,610 rupees in the corresponding month of last year. The imports of American electrical instruments into India during last year were valued at £115,416, as compared with £62,208 in 1925. There was also an increase in the imports of American electrical machinery—from £71,152 to £109,872.

American Exports to the United Kingdom.—According to the preliminary official figures published in *Commerce Reports*, the value of electrical apparatus exported by the United States to the United Kingdom during 1925 was $5,391,101. The largest class was radio apparatus, which was valued at $644,916. Other important items were:—Sparking plugs, magnetos, and other ignition apparatus, $641,096; insulating material, $425,776; motor-driven household devices, $404,281; motors under 1 h.p., $398,834; telephone equipment (other than switchboards), $394,577; domestic heating and cooking devices, $195,868; meters and testing apparatus, $190,583; and storage batteries, $162,700. The total shows an increase of 11 per cent. over the 1924 figure.

Electrical Exhibition at Melbourne.—We wish to draw the attention of electrical manufacturers to a letter appearing in our "Correspondence" pages to-day with reference to an electrical exhibition which is to be held in Melbourne from September 10th to October 1st, 1927.

New French Company.—A company has recently been formed in Paris (13, Rue de Turbigo) with a capital of 440,000 fr., and the title La Société des Lampes Fluoria, to manufacture electric lamps and apparatus.

American Activity in New Zealand.—*Commerce Reports* says that everywhere in New Zealand there is evidence of American activities, and mentions radio apparatus and electrical fittings as two classes of goods which are prominent. It attributes this to four factors, *viz.*, the impressions gained by New Zealand tourists in America; the large number of American firms "located" in New Zealand towns; the activities of American salesmen; and the influence of American publications in the Dominion.

Lighting and Power Notes.

Alloa.—TRANSFER OF UNDERTAKING.—A recommendation by a special committee that the Town Council dispose of its electricity undertaking to the Scottish Central Electric Power Co. for the sum of £100,000 was unanimously adopted at a meeting of the Council on November 5th. It was explained that the deficit on the undertaking was over £130,000, that a considerable portion of the borrowed capital represented expenditure incurred to supply the local shipyards with energy, and that the revenue anticipated

from that source did not materialise, as shortly after the installation of new plant the yards closed down and had not reopened.

Ashton-in-Makerfield.—Inauguration of Supply.—A bulk supply of electricity from Wigan Corporation was recently inaugurated. Electricity is supplied at a pressure of 6,600 V and stepped down to 400 V for power and 230 V for lighting. The scheme has been carried out under the supervision of Mr. W. J. H. Wood, electrical adviser to the Council. The sub-station plant comprises two 300-kVA transformers and h.p. switchgear supplied by the English Electric Co., Ltd. The Wigan Corporation, for whom W. T. Henley's Telegraph Works Co., Ltd., acted as the cable sub-contractors, installed the l.p. cables and services.

Canterbury.—Electricity Supply.—The City Council has asked the Kent Electric Power Co. and the South-East Kent Electric Power Co. whether they intend to give a supply of electricity to the parishes of Fordwich, Sturry, Westbere, St. Stephen's, Harbledown, and a portion of Blean, and if not, whether they would oppose an application by the Council for an Order to include those parishes in its area of supply.

Continental.—Belgium.—The annual report of the Compagnie Auxiliaire d'Electricité, of Brussels, for the year ended June 30th last shows that electricity is now supplied to 93 localities, as against 82 in the previous year. The h.p. distribution system was increased from 205 to 235 miles, the secondary system from 392 to 435 miles, and the sales of electrical energy advanced from 41,906,000 to 49,650,000 kWh. At the central station at Antoing, which has a capacity of 32,000 kVA, two new boilers are being installed and a new 13,000-V transmission line is being laid between Antoing, Peruwelz, and Beloeil. At the Hoeylaert station a new turbo-generator is being installed.

Dartford.—Electricity Supply.—The Urban District Council has been advised that the terms of the West Kent Electric Power Co., Ltd., for a supply of electricity in bulk are not sufficiently attractive to justify at the present time a cessation of local generation, and unless the Electricity Commissioners are prepared to agree to the Council extending its own generating plant, it is proposed to call for a public inquiry into the application for a loan for additional generating plant.

Dulverton.—Electricity Supply.—At a meeting of the Rural District Council on November 5th consent was given to an application of the Dulverton Electric Lighting Co., Ltd., for a Special Order covering the whole of the rural district of Dulverton, the urban district of Wiveliscombe, and the town of Milverton.

Eccles.—Year's Working.—The accounts of the Corporation electricity undertaking (engineer: Mr. H. W. Angus) for the year ended March 31st last record a total revenue of £42,596, as compared with £41,018 in 1924-25. Working expenses amounted to £29,989, as against £29,331, leaving a gross profit of £12,607 (£11,689). After deducting capital charges there was a net surplus of £1,212, as compared with £3,377 in the preceding year. This was transferred to reserve, which now stands at £13,990. The sales of electrical energy increased from 4,942,464 to 6,029,653 kWh.

Edinburgh.—Year's Working.—The report of the city electrical engineer, Mr. E. Seddon, on the working of the electricity undertaking for the year ended May 15th last shows a total income of £490,347, and working expenditure of £279,467, leaving a gross profit of £210,880. The figures for the preceding year were: Income, £460,454; working expenses, £243,286; gross profit, £217,168. Interest absorbed £101,195, contribution towards liquidation of debt for capital expenditure, £102,422, and income tax £10,599, resulting in an adverse balance of £3,836. The previous year's working resulted in a net surplus of £6,175. The capital expenditure during the year amounted to £199,441, the chief items being £97,068 for machinery and plant and £87,793 for mains and cables. The sales of electrical energy increased from 65,638,593 to 79,776,110 kWh, and the maximum supply demanded from 34,000 to 40,700 kW. New plant placed in commission during the year included one 10,000-kW turbo-alternator, two 65,000-lb. water-tube boilers, and eight new sub-stations. The Committee has recommended the Council to proceed immediately with the extension of Portobello station to accommodate two 25,000-kW turbo-alternators, with the necessary auxiliaries.

Glasgow. — Progress during September. — During the month of September 123 houses were wired under the Corporation Electricity Department's scheme, bringing the total to 2,677, while the number of applications for the hire of appliances was 503, bringing the total to 11,292.

Halifax.—Year's Working.—The report on the working of the Corporation electricity undertaking (engineer: Mr. W. M. Rogerson) for the year ended March 31st last shows a total income of £182,467, as compared with £180,679 in the preceding year. Working expenses amounted to £98,291, as against £96,546, leaving a gross profit of £84,175 (£84,133), to which was added interest on investments of £5,631, making a total of £89,806. After providing for capital charges, there was a net surplus of £23,854, as compared with £23,026 in 1924-25. A contribution of £7,466 was made to the borough fund. The capital expenditure during the year amounted to £67,578, the chief item being £49,136 for mains and services. The sales of electrical energy increased from 23,668,249 to 25,385,352 kWh, and the maximum supply demanded from 12,540 to 13,800 kW. The average price obtained per kWh fell from 1.832d. to 1.724d.

Leeds.—Proposed New Station.—We have been informed by Mr. C. Nelson Hefford, manager of the city electricity undertaking, that the Council has purchased 103 acres of land at Kirkstall for the erection of a new power station, and, after prolonged discussion with the Electricity Commissioners, intimation has been received that, subject to the necessary formalities being carried out, the Commissioners are prepared to consider an application to erect a new station. The scheme provides for a station with a capacity of some 150,000 kW, the total cost being estimated at £2,000,000, and the probable cost of the first installation at £800,000. The area of the site would permit of an expansion to accommodate plant of considerably more than 150,000 kW if it became desirable. The site is well chosen, being bounded on one side by the River Aire, and on the other by the Leeds and Liverpool Canal. Favourable conditions also exist with regard to railway siding accommodation.

London.—St. Pancras.—In his annual report, the Mayor states that during the year ended March 31st last the consumption of electricity was 23,407,379 kWh, as compared with 21,047,231 kWh in the preceding year. Of this output 11,569,690 kWh was for power, heating and cooking purposes, as compared with 9,876,756 kWh in the preceding year. The maximum load was 16,010 kW, as against 13,493 kW. The gross turnover for the last financial year was £226,870, and the gross profit was £112,570. The net profit amounted to £21,439, and of this sum £20,556 was allocated to the relief of rates.

Stepney.—The accounts of the Borough Council's electricity undertaking (engineer: Mr. W. C. P. Tapper) for the year ended March 31st last record a total income of £259,286, as compared with £287,505 in the preceding year, the decrease being due to a reduction in the charges for electricity. Working expenses decreased from £153,287 to £143,054, leaving a gross profit of £116,232, as against £134,218, to which was added revenue from other sources making a total of £122,768. After deducting capital and other charges there was a net surplus of £29,447, as compared with £55,682 in 1924-25. The capital expenditure during the year amounted to £168,305, and included £59,042 for mains, £36,835 for machinery, and £36,574 for buildings. The electrical energy sold increased from 44 520,753 to 45 037,107 kWh, and the maximum supply demanded from 21,680 to 24,770 kW. The average price obtained per kWh fell from 1.528d. to 1.351d. During the year a 10,000-kW set was put into commission, bringing the total capacity of the plant installed up to 42,000 kW.

Lossiemouth.—Electricity Supply.—The Town Council is to make a general reduction of 10 per cent. in the price of electricity for lighting and power. A new crude oil generating set of 60-kW capacity is to be installed at the works at an estimated cost of £1,700. The burgh electrical engineer, Mr. R. A. Trail, estimates that in fuel alone the annual saving will be £129.

Manchester.—Progress during September.—During the month of September the Corporation electricity undertaking showed an increase in connections of 1,638 kW, bringing the total to 291,464 kW; and the number of applications received for supply, including consumers for additional supplies, was 1,271, representing a total of 2,855 kW. The number of hired cookers connected increased by 107, bringing the total actually on circuit to 2,188. Applications for the hire of cookers totalled 200. A new 750-kW converter was put into commission at Whalley Range sub-station during the month.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

Haslingden.—Domestic supplies: An increase of ½d. per kWh.

Paisley.—An increase of 10 per cent.

Gorseinon.—*The Gorseinon Electric Light Co.*—An increase of 10 per cent.

Harwich.—An increase of 12½ per cent.

Portsmouth.—Flat rate: An increase of 1d. per kWh. Supplies under the domestic and business tariffs: An increase of ½d. per kWh.

Kirkcaldy.—An increase of 20 per cent.

Sheffield.—Assisted Wiring Scheme.—A report on the working of the Corporation assisted wiring scheme has been prepared by the general manager, Mr. S. E. Fedden, and was recently presented to the City Council. The total number of applications received in the 18 months during which the scheme has been in operation was 7,889, the number accepted and passed for completion, 5,910; and the number under consideration, 454. The remaining 1,525 were withdrawn by the applicants mainly owing to their remote situation with regard to existing distribution mains. The total number of kWh supplied to the end of September was 313,497.

Southend-on-Sea.—ELECTRICITY SUPPLY.—At a meeting of the Town Council on November 9th, the Electric Lighting Committee reported that it had been in communication with the County of London Electric Supply Co., Ltd., with regard to a bulk supply of electricity, and that the company was to present to the Council an amended offer. It was decided to adjourn further consideration of the matter until the offer of the company was received.

The resignations of Mr. J. H. Rider, as consulting engineer to the Council, and Alderman Tweedy Smith from the chairmanship of the Electric Lighting Committee are reported by the *Thameside Mail*.

Special Orders.—Application has been made to the Electricity Commissioners by the Stone Urban District Council for a Special Order authorising it to supply electricity in the urban district and in the parishes of Stone, Barlaston, and Trentham.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Urban District Council of Milford Haven to supply electricity in the urban district, and the Newcastle-upon-Tyne Electric Supply Co., Ltd., in the urban district of Rothbury, and parts of the rural district of Alnwick and Rothbury.

Straits Settlements.—GEORGE TOWN (PENANG).—We have received from Mr. W. J. Williams, engineer and manager of the municipal electricity undertaking, a copy of his report covering the year ended December 31st last. The total revenue amounted to £105,396, and working expenses were £63,453, leaving a gross profit of £41,843. The previous year's figures were:—Income, £91,555; working expenses, £63,461; gross profit, £28,094. To the gross profit was added interest of £935, making a total of £42,778 available. Interest and sinking fund charges absorbed £25,857, and there was a net surplus of £16,921, as compared with £6,462 in the preceding year. The capital expenditure during the year amounted to £185,057, and included £74,481 for machinery and plant, and £41,373 for submarine cables. The electrical energy sold increased from 5,284,501 to 6,564,011 kWh. The most important extension carried out during the year was the linking-up of the new Prai station with the new main sub-station at Dato Kramat, a distance of 10 miles, involving the laying of about 4½ miles of submarine cable.

Sunderland.—ELECTRICITY SUPPLY.—The Corporation has decided to extend mains in a number of streets at a total estimated cost of £2 819. The scheme for converting all street lamps in the borough from gas to electric lighting has now been completed.

Uttoxeter.—OPPOSITION TO SCHEME.—The Urban District Council has decided to oppose the scheme promoted by the Power Development Co., Ltd., to supply electricity in its area.

Walsall.—TRANSFER OF UNDERTAKING.—The Town Council has been recommended to approve an agreement for the transfer of the Birchills power station from the Corporation to the West Midland Joint Electricity Authority.

ELECTRICITY EXTENSIONS.—It is also recommended that additional plant be installed at a cost of £140,721, and that an interconnecting main be laid between Birchills and Ocker Hill power stations at a cost of £9,200. These extensions form part of a scheme adopted by the Joint Electricity Authority.

York.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to a loan of £18,777 for mains and services.

Tramway and Railway Notes.

Australia.—MELBOURNE.—We have received from the Melbourne and Metropolitan Tramways Board a copy of the report on the working of its undertaking for the year ended June 30th last. The electric tramways earned a total revenue of £1,007,210, an increase of £253,513 as compared with the preceding year. The working expenses amounted to £816,178, as against £649,644, leaving a gross profit of £191,032 (£106,519), which was carried to net revenue account with a gross profit of £201,312 from the cable tramway and another small item, making a total of £393,424, against which the following charges were made:—Capital and other charges, £250,000; deficit on the motor-omnibus service, £14,984; contribution to municipal and other rates, £20,489. There was, therefore, a balance of £128,439, which was transferred to appropriation account. After meeting statutory payments to State consolidated revenue and reserves, there was a net deficit of £242,477. The number of passengers carried by the electric tramway system increased from 80,435,680 to 99,017,938, and the car-mileage from 8,426,519 to 10,657,728. The expenditure during the year on the construction of tramways, conversion of cable tramways to electric traction, &c., amounted to £1,202,847. During the year 14 miles of cable tramway were converted to electric traction, eight miles of new track laid, and four miles of existing track duplicated. Repair shops are in course of erection at Preston, the cost of which will amount to approximately £200,000.

Bournemouth.—TRACK RENEWALS.—The Corporation Tramways Committee is to invite tenders for the reconstruction of the tramway track in Lower Parkstone Lane. The estimated cost is £80,000.

Continental.—ITALY.—A scheme is proposed for the construction of a tunnel through Mont Blanc to provide better means of railway communication between Italy, France, and Western Europe. The tunnel would be a little over nine miles and the railway would be electrified.

Gravesend.—ABANDONMENT OF TRAMWAY.—The Gravesend and Northfleet Electric Tramways Co., Ltd., has applied to the Minister of Transport for an Order authorising it to abandon its tramway undertaking and to substitute services of motor omnibuses or other vehicles.

Grimsby.—RAILLESS CARS.—In view of the satisfactory results from the experiment with railless cars, the Tramways Committee has recommended to the Town Council that application be made for sanction to introduce railless cars on several new routes.

Manchester.—LOAN SANCTIONED.—The Finance Committee has reported the receipt of sanction to a loan of £325,000 for part cost of purchase of 50 new tramcars, the conversion of 200 single-truck cars, and the vestibuling of 40 cars.

Sheffield.—NEW ROUTE.—The City Council is to seek sanction to construct a tramway track along the new Prince of Wales Road.

Straits Settlements.—GEORGE TOWN (PENANG).—The report on the working of the municipal tramway undertaking (manager: Mr. W. J. Williams) for the year ended December 31st last shows a total revenue of £30,841, as compared with £27,924 in the preceding year. Working expenses amounted to £23,659, as against £22,971, leaving a gross profit of £7,463 (£4,952). After deducting capital charges, there was a net profit of £2,099, as compared with £470 in 1924. The number of passengers carried was 7,245,201. The above figures include those for the omnibus and railless-car systems.

Telegraph and Telephone Notes.

Brazil.—TELEPHONE EXTENSIONS.—Permission has been granted by the State Government to Messrs. Dorotheu Araujo y Cia for the extension of the telephone system to a number of villages and towns, subject to the co-operation of the Telephone Company of Pernambuco, which holds a concession for the whole of the State's telephones. The first installation will be made at Ribeirao, which is to form the nucleus of a wide rural telephone system.—*Reuter's Trade Service* (Pernambuco).

Portugal.—NEW WIRELESS SERVICE TO AFRICA.—An international radio-telegraph service will shortly be inaugurated by the Companhia Portuguese Radio Marconi between Lisbon, the Azores, Madeira, Cape Verde, Angola, Mozambique, and North and South America. There will, of course, be connection with the whole world through the radio centres of Paris and London.—*Reuter* (Lisbon).

Radio Notes.

B.B.C. Finance.—SUPPLEMENTARY GOVERNMENT ESTIMATE.—In a supplementary Parliamentary estimate introduced on November 11th is included a further sum of £295,000 for the revenue department of the General Post Office in connection with broadcasting. The original estimate was £560,000, and the revised estimate is £855,000. It is explained that £112,000 is in respect of additional payments to the British Broadcasting Co. in respect of expenses of the service from April 1st to December 31st, 1926, and £183,000 is for expenses of the service from January 1st to March 31st, 1927. This money will enable the company's service to be carried on pending its liquidation and the taking over of the undertaking by the B.B. Corporation in the new year. The estimate was passed by the House of Commons.

Bolivia.—NEW STATIONS.—Five stations are to be built in Bolivia. According to information received by the Bolivian Legation in London, they are to be erected at Sucre, Potosi, Tarija, Monteagudo, and Azurduy, and the Finance Committee of the Bolivian Chamber of Deputies has voted 150,000 bolivianos, equal to £11,875, to cover the cost. A successful radio club has been in existence for some time at La Paz, and a regular programme is broadcast, but this is a private venture, and is financed by members' subscriptions. The new stations are to be controlled by the Government.

Brazil.—NEW STATION.—A radio station has been opened at Olinda, in the State of Pernambuco; Olinda has a population of over 8,000, and other towns within the area of the service are Bezerros (17,500); Bomjardim (40,000); Brejo de Madre de Dios (13,650); Garanhuns (35,000); and the increasingly important port of Victoria (33,000).—*Reuter's Trade Service* (Pernambuco).

Holland.—WIRED-WIRELESS.—The service of broadcast radio-telephone distribution by ordinary telephone which was recently inaugurated by the Municipal Telephone Administration at The Hague, has already afforded daily pleasure to some two hundred subscribers, who, it is stated, are loud in their praises of the new scheme. Some thousand applications have been received from would-be subscribers, who are

being linked up at the rate of 15 per day. It is declared that the new scheme is working successfully; the only disturbance so far experienced is from the electric tramways, but is negligible. Full agreement has not yet been reached with transmitting authorities, but it is hoped that a definite licence for the receipt of wireless programmes will be secured after the December meeting of the Council of the International Radio Bureau in Geneva. From a juridical standpoint The Hague Municipal Telephone Administration is not committed to anything, but the Postal and Telegraph Administration intends to extend this service in the near future to the Government telephone lines.—*Reuter* (Amsterdam).

Each subscriber has, as an attachment to his telephone installation, a small box containing inexpensive apparatus to which either earphones or a loud-speaker can be connected. The annual charge for the service is 30s.

NEW TRANSMITTING STATION.—The Netherlands Postal and Telegraph Administration announces that it has been definitely decided to erect a new transmitting station at Scheveningen, and that it will be available for use at the beginning of the year. The energy and depth of the modulation will not be any stronger than is necessary to make the spoken word easily audible throughout the country with the aid of a valve set and a loud speaker. The wave-length will be 1,950 metres. —*Reuter* (Amsterdam).

India.—STATION SITES.—The Board of Trustees for the Improvement of Calcutta has considered an application from the Indian Radio Telegraph Co., Ltd., stating that the proposed rental of Rs. 1,000 for the land required for the broadcasting station in the Cossipore-Chitpore open space is prohibitive and asking the Board to make a reduction. After some discussion it was decided to offer the site at a rental of Rs. 250 per month for the first two years of the lease and Rs. 500 per month for the remaining period. *Indian Engineering* states that the company proposes to establish its station in Bombay next cold weather. The company has applied for the lease of a plot of land in the new public park laid out by the Western India Turf Club.

Peru.—NEW STATIONS.—A broadcasting station has been opened at Arequipa (population 37,000), capital of the Arequipa Department, which has a population of nearly 300,000. The station operates under the auspices of "OAX Lima," and transmits on a 275-metre wave. A concession has been granted to Señor Luis Ansiaux for a larger station, which will operate jointly with this one.—*Reuter's Trade Service* (Arequipa).

Prosecution.—TRANSMITTER FINED.—A station which transmitted under the call signals 60K and 5UH having been located by Manchester Post Office engineers after a search lasting more than a year, the owner of the unauthorised "station," Cyril J. Smith, of Timperley, Cheshire, was fined the maximum penalty of £10, with £5 costs, at Altrincham, says the *Daily Mail*, on a charge of having worked apparatus for wireless telegraphy without having a licence. The magistrates also ordered that his apparatus should be forfeited. Smith said he first applied for a transmitting licence in 1924, but received no reply, and then again in November, 1925. He offered to send prints of his intended patents, but, receiving no reply, he was tempted to carry on his experiments. He had had numerous letters to the effect that his application was being considered.

Russia.—HIGH-POWER STATION.—It is reported that a new broadcasting station is to be built in the Kaschira-Schatura district, the power of which will be 1,000 kW.

Wireless for the Blind.—FREE LICENCES.—In the House of Commons on November 10th, Captain Ian Fraser, M.P., moved the first reading of his Wireless Telegraphy (Blind Persons Facilities) Bill, which proposes that when a person satisfies the Postmaster-General that he is a blind person within the meaning of the measure, a licence to establish, maintain, and work a wireless-telegraphy station for the purpose of receiving messages only may be granted to him subject to such terms, conditions, and restrictions as the Postmaster-General may think fit, but without payment of any fee. A blind person is deemed to mean any person not being resident in a public or charitable institution or in a school who produces a certificate issued by the council of the county or of the county borough in which he is ordinarily resident, that he is registered as a blind person in that area.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—January 4th, 1927. P.M.G.'s Department. Bells and buzzers. (B.X. 2984.)*

January 18th, 1927. Switchboard cable. (B.X. 3013.)*

January 25th, 1927. Telephone transmitters and parts. (B.X. 3012.)*

SYDNEY.—January 26th, 1927. New South Wales Government Railways. Electric railway car equipments, consisting of motors, control equipment, air compressors, pantographs and accessories (Spec. 1065). (A.X. 3810.)*

Municipal Council. December 1st. Tungsten filament electric lamps. (B.X. 2995.)*

Brighton. — November 25th. Electricity Department. One 15,625-kW turbo-alternator, with condensing plant and auxiliaries. (November 5th.)

Cardiff.—November 22nd. Electricity Department. One water-tube boiler, mechanical stokers, and forced-draught plant; steel chimney and grit-collecting plant; induced-draught plant. (October 29th.)

China.—SHANGHAI.—January 15th, 1927.—The Department of Overseas Trade states that a Chinese company holding a concession for the supply of water and electricity is inviting tenders for plant, comprising turbo-generators, condensers, boilers, switchgear and transformers, pumping set, and hand-operated travelling crane. (B.X. 2998.)*

Cleethorpes.—December 11th. Electricity Department. E.h.p. feeder and l.p. distributor cables, section pillars, and disconnecting boxes, transformers and switchgear equipment, and house services, including meters. (See this issue.)

Consett.—Urban District Council. Electric lighting installation in the Market Square. (November 12th.)

Croydon.—November 26th. Tramways Department. 10 complete bodies for electric tramcars, 10 sets of maximum traction bogie trucks, 10 sets of magnetic track and wheel-brake equipments, and 10 sets of electrical equipments, &c. (November 5th.)

Dublin.—December 9th. Great Southern Railway Co. Six months' supply of electric cables, electric lamps, &c. Forms of tender (6d. each) from the Stores Superintendent, G.S. Railways, Inchicore, Dublin.

Egypt.—CAIRO.—December 5th. Ministry of the Interior. Electric motors and accessories. (B.X. 2996.)*

Ministry of Education. December 16th. Five a.c. motors and switchboard for Assiout model workshops. (B.X. 3016.)*

Erith.—November 30th. Electricity Department. L.p. cables. (See this issue.)

Farnworth.—November 22nd. Electricity Department. L.p. cables, distribution pillars, underground disconnecting boxes, house service cables and accessories. (November 12th.)

Hastings.—November 30th. Corporation. Two sets of electrically-driven turbine or centrifugal deepwell pumps, with all electrical equipment, &c. (November 5th.)

India.—December 21st. India Store Department. 280 miles (approx.) 110,000-V overhead transmission line. (October 29th.)

December 7th. Madras and Southern Mahratta Railway Co., Ltd. Sixteen 35-b.h.p. short-circuited rotor motors and two 10-b.h.p. ditto, complete with pulleys, slide rails, starting switches, &c. (See this issue.)

London.—HAMMERSMITH.—November 26th. Electricity Department. Two water-tube boilers (45,000 lb. per hour), mechanical stokers, feed-water pumps, fans, piping, conveyors, bunkers, &c. (November 12th.)

Manchester.—November 22nd. Electricity Committee. Steelwork, &c., for extension of existing station, in turbine house, boiler house, switch house, and subsidiary works. Specification from Mr. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.

November 23rd. Tramways Committee. Copper bonds for tramway rails. Specification from Mr. H. Mattinson, chief engineer and manager, 55, Piccadilly, Manchester.

Meltham (near Huddersfield).—December 31st. Wiring, fittings, &c., required in the electric lighting of the Parish Church. Particulars from Mr. W. R. Carter, secretary, Church Council, Birchfield, Meltham.

New Zealand.—WELLINGTON.—January 4th, 1927. Public Works Department. Waikaremoana electric power scheme. Switchgear and transformers. (B.X. 2872.)* January 18th, 1927. Transmission line steel towers. (A.X. 3732.)* February 1st, 1927. Storage battery and booster. (B.X. 2937.)*

February 15th, 1927. Transformers for Waikato. (B.X. 2985.)*

December 14th. Sub-station cables and cable boxes for Arapuni. (B.X. 3010.)*

December 15th. Government Railways. Switchgear, cable, motor-generator sets, junction boxes, &c., for the Hutt Valley locomotive workshops. (B.X. 2949.)*

Post and Telegraph Department. December 6th. Key switches. (B.X. 2962.)*

January 17th, 1927. Switchgear, cables, motor-generator sets, &c. (B.X. 3020.)*

January 19th, 1927. Electric bells and tumbler switches. (B.X. 3011.)*

Nottingham.—December 31st. Electricity Department. Two 30-in. electrically-driven pumps, one motor-driven twin booster, one 256-cell storage battery. (See this issue.)

Oxford.—December 8th. Oxford Electric Co., Ltd. One 7,500-kW turbo-alternator, with condensing plant and auxiliaries. (See this issue.)

Prestatyn.—December 6th. Urban District Council. Underground cables, overhead lines, transformers, e.h.p. and l.p. switchgear, and sub-station equipment. (November 12th.)

Siam.—December 15th. Royal Siamese Post and Telegraph Department. Telephone and submarine cable. (B.X. 3026.)*

South Africa.—KEETMANSTROOP.—December 15th. Municipal Council. Material required for an electric lighting scheme. (B.X. 3007.)*

JOHANNESBURG.—December 11th. Municipal Council. H.p. cable. (B.X. 3017.)*

CAPE TOWN.—December 15th. Electricity Department. Oil-cooled transformers. (B.X. 3028.)*

Sutton Coldfield.—December 14th. Electricity Department. One 1,000-kW steam turbine, with condensing plant, auxiliaries, and piping. (November 12th.)

Worthing.—November 23rd. Corporation. Fire-alarm system. (November 5th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—SYDNEY.—Municipal Council. Accepted :—
Nineteen 11,000-kVA single-phase transformers to form 33,000-kVA, 3 phase banks for the Bunnerong power station.—Ferranti, Ltd.

MUDGEE.—Municipal Council. Accepted :—
Installation of electric lighting and power plant (approx. £36,000).—Crompton & Co., Ltd.

Dublin.—Borough Commissioners.
Arc-lamp carbons for 12 months.—Photector Co., Ltd.; Sloan Electrical Co., Ltd.
Time switches.—Rooper Bros.
—*Irish Builder and Engineer.*

Dundee.—Public Health Sub-Committee.
Electric lighting installation at the Welfare Clinic extension.—R. M. Lindsay.

Durham.—County Council. Accepted:—
Electric lighting installation, Leamside Elementary School (£262).—F. Reid, Ferens & Co.
Electric lighting installation at Sunniside School (£134).—Simm & Richardson.
Electric lighting at Earl's House Sanatorium (£492).—Law & Burns.

Glasgow.—Electricity Committee. Accepted:—
Two 800-kVA transformers (£1,270).—C. A. Parsons & Co., Ltd.
Four 200-kVA transformers (£960); six 400-kVA ditto (£2,310).—Bruce Peebles & Co., Ltd.

Cleansing Committee. Recommended :—
Installation of electrical plant at refuse works (£95,056).—Heenan and Froude, Ltd.

Grays.—Urban Council. Accepted:—
Rotary converters (£3,241).—Crompton & Co., Ltd.

London.—ADMIRALTY.—
Night-light lamps.—Edison Swan Electric Co., Ltd.

GENERAL POST OFFICE.—
Telephone switchboard lamps.—Edison Swan Electric Co., Ltd.

LONDON COUNTY COUNCIL.—
X.W.2 accumulators.—Edison Swan Electric Co., Ltd.

Highways Committee.—Greenwich power station, three boiler units and incidental works :—

	Stoker-fired boilers.	Pulverised fuel boilers.
	£	£
Clarke, Chapman & Co., Ltd. (Accepted.)	76,190	79,944 (alternative)
Stirling Boiler Co., Ltd.	82,915	—
Simon-Carves, Ltd.	—	84,764
Vickers Boiler Co., Ltd.	85,000	—
Richardsons, Westgarth & Co., Ltd.	85,000	100,000 (alternative)
Babcock & Wilcox, Ltd.	86,976	—
International Combustion, Ltd. ...	—	93,100

The estimate of the general manager of the tramways, comparable with the tenders, was £119,000. The Committee has made arrangements with Messrs. Clarke, Chapman & Co., Ltd., to install grit-catching apparatus at an additional cost of £1,760.

METROPOLITAN ASYLUMS BOARD.—
X-ray apparatus (£164).—Schall & Son. (Recommended.)

Automatic telephones and time alarms at North-Eastern Hospital :—

T. Clarke & Co., Ltd. (Recommended.)	**£2,417**
Douglas Electric Lighting and Power Co.	2,450
Read & Partners, Ltd.	2,463
Reliance Telephone Co., Ltd.	2,545
V. G. Middleton & Co., Ltd.	2,570
Toy & Winslow	2,690
International Electric Co., Ltd.	4,288

Electric lighting alterations at North-Eastern Hospital :—

Douglas Electric Lighting & Power Co. (Recommended.)	**£150**
Alpha Manufacturing & Electrical Co., Ltd.	150
T. Clarke & Co., Ltd.	160
Read & Partners, Ltd.	168
Toy & Winslow	185
Brightside Foundry & Engineering Co., Ltd.	355

Otley.—
Electrician's work in Council houses (£310).—T. W. Buxton.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted :—
Power-factor corrective apparatus (£1,224).—British Insulated Cables (S.A.), Ltd.

Tenterden.—Town Council. Accepted:—
Installing electric lighting at the Town Hall.—Milsted & Sons.

Walsall.—Town Council. Recommended:—
Interconnecting main between Birchills station and the Ocker Hill Boiler plant (£91,881).—International Combustion Co., Ltd.
Interconnecting main between Birchills station and the Ocker Hills station (£9,200).—British Insulated & Helsby Cables, Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, November 19th. London. 7.30 p.m. "Short-wave Wireless Communication." Mr. B. J. Axten.

Institution of Mechanical Engineers.—Friday, November 19th. Storey's Gate, S.W. 6 p.m. "Electric Locomotives." Mr. T. A. F. Stone.

British Electrical Development Association.—Friday, November 19th. Royal Society of Arts. 7.30 p.m. "Shop Window Display." Mr. E. Wilson.

Electrical Trades Commercial Travellers' Association.—Friday, November 19th. St. Bride's Institute, E.C.4. 7 p.m. Annual general meeting.

Midland Electrical Engineers.—Friday, November 19th. Grand Hotel, Birmingham. Annual ball.

Electrical Power Engineers' Association (Kent Section).—Saturday, November 20th. Maidstone. 3 p.m. General meeting. 6.30 p.m. Annual dinner.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, November 22nd. London. 7 p.m. "Comparative Electrical Progress in European Countries." Mr. J. F. Shipley.

(Mersey and North Wales (Liverpool) Centre).—Monday, November 22nd. University, Liverpool. 7 p.m. "The Design of City Distribution Systems." Messrs. J. R. Beard and T. G. N. Haldane.

(North-Eastern Centre).—Monday, November 22nd. Sopwith's Lounge. 7 p.m. Informal meeting.

Wednesday, November 24th. Literary and Philosophical Society, Newcastle-on-Tyne. 7 p.m. Faraday Lecture, "What is Electricity?" Prof. W. M. Thornton.

(South Midland Centre).—Friday, November 26th. Grand Hotel, Birmingham. Annual dinner.

Royal Society of Arts.—Monday, November 22nd. 8 p.m. "Recent Experiments on the Properties of Steam at High Pressure." Prof. H. L. Callendar, F.R.S.

Institution of the Rubber Industry.—Tuesday, November 23rd. Engineers' Club, W. "Selenium." Mr. C. R. Boggs.

Royal Institution.—Tuesday, November 23rd. 21, Albemarle Street, W. 5.15 p.m. "Imperfect Crystallisation of Common Things." Sir Wm. Bragg.

Saturday, November 27th. 3 p.m. "Atmospheric Electricity." Mr. G. C. Simpson.

South Wales Institute of Engineers.—November 24th to December 4th. Drill Hall, Cardiff. Engineering Exhibition.

Physical Society of London.—Friday, November 26th. Imperial College of Science, S.W. 5 p.m. Ordinary meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

ARDWINNOT insulation.

We also desire to learn the address of MESSRS. KILROY AND ELLIOTT, makers of fire-fighting control for warships.

Notes.

Association of Mining Electrical Engineers.—SOUTH WALES BRANCH.—Major E. Ivor David, of Aberaman, chief electrical engineer under the Powell Duffryn Steam Coal Co., read an important paper on the "Protection of Alternating-Current Systems against Short Circuits" at the South Wales Branch of the Association of Mining Electrical Engineers. Mr. Dawson Thomas, A.M.I.E.E., occupied the chair, and it was significant of the importance attached by the members to Major David's lecture that Mr. C. T. Allan, M.I.E.E., assistant manager of the South Wales Power Distribution Company, offered £10 towards the cost of issuing it in separate form, and the chairman said that Mr. Allan's suggestion would receive consideration from the committee. Mr. H. B. Haslam, M.I.E.E. (Cardiff), who opened the discussion, described the paper as a classic on the subject which, in effect, discussed the best methods to secure safety by the use of electrical energy in mining engineering.

In his paper, Major David said that in the earlier days, when plants were smaller and voltages low, apparatus which was capable of operating under normal conditions was usually also capable of dealing with the abnormal conditions produced by short circuits, but with the greatly increased capacity of generating plants, particularly where a number of collieries were linked together electrically, there had resulted conditions in which apparatus amply proportioned for normal working might be inadequate for short-circuit conditions. By a proper selection of apparatus and provision of suitable current-limiting devices, together with protective gear, even the largest systems could be made safe. The forces available for destruction at any point in a system could be calculated with a reasonable degree of accuracy. The author gave a method of calculation and dealt with his subject very fully, giving also some of his experiences in the successful use of reactors.

Large Electric Locomotives.—The Pennsylvania Railroad has placed an order with the Westinghouse Electric and Manufacturing Company for electrical equipment for 93 coaches and motors and control gear for four electrical passenger locomotives of the type previously ordered. The new locomotives have a continuous rating of 3,730 h.p. each, and thus, as regards both tractive effort and speed, will compare with the largest existing steam locomotive. When completed they will weigh approximately 400,000 lb. each, with a total length of 68 ft. Each will have a 2-8-2 wheel arrangement with the motors arranged two per jack shaft. Each jack shaft in turn has two pairs of "drivers" almost 7 ft. high. The gear ratio of each locomotive will permit of a sustained speed of 70 miles per hour if desired.

Power and Its Distribution.—In a booklet issued under the above title, by Mr. C. E. Tripp, chairman, Westinghouse Electric and Manufacturing Co., which covers an address delivered before the Congress of American Industry, the author traces the part played by power in the development of industrial America, from the time of the first settlers at Jamestown up to the present day. American superiority in electrical development, he says, is largely due to the fact that in that country electric light and power systems grew up without interference on the part of Government authorities. American workmen have now at their disposal an average of 3½ h.p. per worker, about double that available to the workman of England. America can now look for rapid electrical developments in Europe, which is now fully alive to the immense gain in production that American industry has secured by the use of electric power. The author predicts that the development of the automobile and "superpower" (electrical) with long-distance transmission will result in the decentralisation of industry and bring it back into step with agriculture. It will mean a fuller use of one of the great natural resources—land. Rural electrification, he says, will conserve transportation by reducing the length of the hauls between the producer, manufacturer, and consumer.

New Power Station at Coventry.—On November 12th, work on the new power station to be built for the Corporation of Coventry, at Hawkesbury Lane, was ceremoniously commenced. The output of the existing station at Sandy Lane is 30,000 kW, but it has been found necessary to supplement this by the provision of a new station, which, it is intended, will have an ultimate capacity of about 100,000 kW. The initial contract, involving a cost of over £500,000, has been placed with the British Thomson-Houston Co., Ltd., and covers the provision of the necessary buildings and equipment for generating 37,500 kW by means of two B.T.-H. turbo-alternators. These will be designed for working on 325 lb. gauge pressure and 700 deg. F. superheat. Generation will be at 6,600 V, three-phase, 50 cycles. A tar-macadam road will be made from the main entrance of the station to the public highway, and a stream at present running through the middle of the site is to be diverted along the boundary by means of a concrete culvert about 500 yards long. Provision is to be made for a new wharf on the Oxford Canal to accommodate two 30-ton barges. The coal will be unloaded by telpher equipment and conveyed to the coal bunkers in the boiler house, where up-to-date steam-raising equipment and coal and ash handling plant will be installed. A transformer bank will be connected to each alternator for raising the pressure to 33,000 V for transmission to the sub-stations. The e.h.p. switchgear is to be of the compound-filled remotely controlled type. A railway track will allow overhauling to be carried out in the engine house.

Tyne R.E. Reunion Dinner.—There was an unusually large attendance at the annual reunion dinner of the officers of the Tyne Electrical Engineers R.E., which was held on November 13th, when the Duke of Northumberland, K.G., Hon. Colonel of the unit, made a presentation to Brevet-Colonel Ernest Robinson, C.B.E., who recently relinquished the command. The presentation took the form of Colonel Robinson's portrait in oils by Mr. Cowan Dobson, R.B.A. Reviewing Colonel Robinson's services, His Grace said that the Tyne Electrical Engineers came out of the greatest test the world had ever seen with flying colours. This was mainly due to the efforts of Colonel Robinson, under whose supervision more than 7,500 officers, N.C.O.s and men of the unit had received training of high efficiency.

Colonel Robinson, in reply, referred to his long and happy association with the unit, and promised it every support in his power in the future.

Major N. H. Firmin, O.B.E., said that the Tyne Electrical Engineers was the first territorial unit to enjoy having His Grace as its Hon. Colonel.

In reply, the Duke said that everyone was aware of the great things which the Tyne Electrical Engineers had accomplished during the war. In any future European conflict the Regular Army would perform its part within the first few weeks, and to the Territorial Army would fall the duty of carrying on.

"The Tyne Electrical Engineers" was proposed by Lieut.-Colonel A. K. Tasker, T.D., and "The Retired and Attached Officers" by Major C. M. Forster, O.B.E. Among the other officers present were: Lieut.-Col. S. E. Monkhouse, Captains J. B. Murray, H. Sherlock, and E. H. E. Woodward, M.C.

Defective Installation Material.—Our attention has been drawn by the Electrical Contractors' Association (Incorp.) to the defective material which is being used in electrical installations throughout the country, and it is suggested that the Association's efforts to raise the standard of installation work have been somewhat frustrated by supply authorities and others concerned in the issuing of electrical contracts not interesting themselves sufficiently in the class of material installed. We have received a sample of wire which is alleged to have been used for wiring a house in Yorkshire. The installation was put in since Christmas, 1925, and has now had to be rewired. The original work was carried out by a non-association contractor who has recently been successful in securing a large contract from a local authority. The insulation of the wire is, if any, little thicker than that to be found on first-class bell wire, and we doubt if its insulating qualities are much higher.

The Electricity (Supply) Bill.—The following letter appeared in *The Times* of November 15th:—

Sir,—We, the undersigned, all of whom are in close touch with the electricity supply industry, consider it a public duty to state our conviction—which we hope by your courtesy to be able to do—that the claims put forward in support of the Government Electricity Bill as it has emerged from the House of Commons cannot be sustained.

We have no confidence that the Bill, should it become law, will either increase the consumption of electricity or reduce its cost to the consumer otherwise than would have been the case without the proposed legislation. After all that has been said upon the subject the question to be answered is why, at a time when the country as a whole is in difficulties, legislation should be introduced of a kind tending to increase rather than allay the present anxieties of those engaged in the business of the development of the electrical industry?

We claim that the criticism of those who have made a life-long study of the industry, who are engaged in it and vitally interested in its development, deserves serious attention, since such criticism arises from special knowledge of all the conditions. Experience has shown that it was precisely the deletion of the clauses in the Bill of 1919 as introduced, for which deletion those engaged in the industry have been blamed, that has enabled the industry under the Electricity Commissioners to make such considerable headway during the past six years.

Our considered opinion is that the unobjectionable features in the present Bill as to interconnection and such standardisation of frequency as may be necessary for this purpose could easily be attained by a short uncontroversial Bill extending the powers of the Electricity Commissioners without imposing on an industry, already over-burdened with legislation, the further burden of a bureaucratic Electricity Board which is to be endowed with uncommercial and almost grotesque powers of interference with expert management.

The development of electricity supply in this country has been seriously hindered by ill-advised legislation. Past efforts of Parliament greatly encouraged parochial developments while imposing onerous conditions on private enterprise, in contrast with the sympathetic support and freedom from undue interference enjoyed by industrial pioneers in other countries. Despite this, the sale of electricity in this country has grown rapidly in recent years, but freedom from further interference is essential to the future welfare of the industry.

We are, Sir, your obedient servants,

R. P. Sloan, chairman and managing director of the Newcastle-upon-Tyne Electric Supply Co., Ltd.
James Devonshire, chairman and managing director, North Metropolitan Electric Power Supply Co.
E. Garcke, chairman, Shropshire, Worcestershire, and Staffordshire Electric Power Co.
J. B. Braithwaite, chairman, City of London Electric Lighting Co., Ltd.
W. B. Woodhouse, general manager and engineer, Yorkshire Electric Power Co.
W. North Lewis, chairman, South Wales Electrical Power Distribution Co.
H. F. Parshall, D.Sc., chairman, Lancashire Electric Power Co.
A. A. Campbell Swinton, F.R.S.

Royal Society Medallists.—The King has approved of the following, amongst other, awards by the Royal Society:—

A Royal Medal to Sir William Hardy, F.R.S., for his pioneer work on colloidal chemistry and the theory of lubrication. Copley Medal to Sir Frederick Hopkins, F.R.S., for his work in biochemistry. Rumford Medal to Sir Arthur Schuster, F.R.S., for his services to physical science, especially in optics and terrestrial magnetism. Davy Medal to Sir James Walker, F.R.S., for his work on the theory of ionisation. Hughes Medal to Admiral Sir Henry Jackson, F.R.S., for his pioneer work in radio-telegraphy and its application to navigation.

Distortion in Wireless Reception. — Mr. A. V. Ballhatchet talked to the members of the Junior Institution of Engineers recently on the subject of "Distortion in Wireless Reception." The root cause of distortion, he said, when using a valve detector was the grid leak, which was usually given two functions to perform: first, to let the charge from the grid condenser leak away at the correct speed, and, secondly, to keep the grid at a definite d.c. voltage. A leak best suited for the one purpose would not necessarily suit the other; the solution was to use one which was correct as a leak, and to vary the d.c. voltage to it by means of a potentiometer. In low-frequency amplification distortion was produced, amongst other ways, by overworking the valve and working on the ends of its characteristic curve in order to get a sufficient large voltage swing for a loud-speaker; one remedy was the use of a larger valve, but the true solution was the use of push-pull amplification, which required two valves and two tapped transformers. This method was not new, but had received little attention from amateurs, and at first sight it might seem an uneconomical proposition, but quite ordinary small valves would do. The gain in purity was well worth the extra consumption in energy, if incurred. Mr. Ballhatchet said he preferred to feed a loud-speaker through a transformer in order to avoid distortion due to the passage of steady d.c. currents, and he also favoured the use of two loud-speakers in parallel.

Italian Electrically-operated Port Canal.—Contracts have been signed for the construction of a canal in Italy which will afford valuable navigation facilities between Naples and the port of Salerno, 33 miles distant by railway. Vessels using the canal will leave from the arrival platform of the Naples-Salerno "Autostrada," and the terminus will be near the Pattison Engineering Works on the seaboard at the north extremity of the bay. The canal will have a length of 2½ km., a width of 15½ metres, and a depth of 2.50 to 2.70 metres. Its cost is estimated at 51 million lire, including that of electrically-operated loading, unloading, and towing apparatus. It is expected that the work, which will start immediately, will take six years, but part of the canal should be available for traffic within two years.—*Reuter's Trade Service* (Naples).

Local Society.—"The Electrical Precipitation of Smoke and Fume" was the subject of a paper read recently by Mr. H. W. C. Henderson, A.R.C.S., A.I.C., before the Bristol section of the Society of Chemical Industries. The speaker said that the problem of recovering smoke, dust or fume from the waste gases from industrial processes was becoming more and more important, not only because of the pollution of the atmosphere, but on account of the great demand for efficiency in all modern processes. To-day, with the practical experience derived from many years' work, it was possible to design the correct size of plant required to meet the particular need and obtain the maximum efficiency. Numerous difficulties which were encountered with early plant had been overcome; practically any fume could be dealt with, and plant was now successfully in operation for the collection of all kinds of dust and fumes. Fractional precipitation could be employed for separating from a gas the suspended constituents of varying condensation temperatures. Describing the predominant features of the electrical precipitation process adopted by Messrs. Lodge-Cottrel, Ltd., the lecturer said that the gases had an unrestricted passage through the apparatus, thus eliminating back-pressure which might hinder any other metallurgical operations, and that no preliminary gas cooling was required, as gases could be treated by this method at any temperature between atmospheric and 1,400 deg. F. The power consumption and the maintenance costs were almost negligible, while the labour and attention required to operate even a large installation were very small.

Electrical Operation in Photography.—An apparatus which has been recently produced by the Aircraft Operating Co., Ltd., and for which the selling agents are Messrs. Vickers, Ltd., is an electrically-controlled air-photography equipment, which forms part of an exhibit prepared for the delegates to the Imperial Conference at the request of the Secretary of State for Air. The various operations of the camera are all controlled from a small switchboard of cigar-box size some distance away, usually in the pilot's cockpit. This gives an indication of the functioning of the various movements of the camera, and a red lamp warns the pilot when a photograph is about to be taken. Normally the mechanism is driven by an electric motor, but should the current fail, it can be driven by an air propeller or by hand. A number of these cameras are already in use by the Royal Air Force, in which it is known as the service type F/8.

E.A.W. Activities.—A meeting of the Electrical Association for Women took place on October 28th at the residence of Mrs. R. A. Chattock (Birmingham), when about 60 guests assembled to hear Miss Griff lecture on "The Housewife her own Electrician." Afterwards a cooking demonstration was given by Mrs. Williams of the Corporation Electric Supply show-rooms, followed by an electric washing demonstration. Other electrical appliances were also exhibited and explained, inciuding a vacuum cleaner. On November 2nd a meeting took place in the Council House, Walsall, when the Mayor of Walsall presided. Lady Brooks, the president, explained the aims of the Association, and Mr. G. E. Francis, of the E.D.A., lectured on "Electricity and Domestic Efficiency" to an interested audience of about 60 people.

Appointments Vacant.—Cable jointers (£400) for the Government of the Gold Coast Posts and Telegraphs Department. Power-house shift charge engineer (£391). Charge engineer for the Stalybridge, Hyde, &c., Joint Board. Assistant to the executive engineer of the power station (800 taels per month), assistant designing engineer (450 taels per month), installation inspector (300 taels per month), tael=2s. 5d. approx., for the Shanghai Municipal Electricity Department. (See our advertisement pages to-day.)

British Engineering Standards Association. — At the recent annual general meeting of the British Engineering Standards Association, marking its 25th year of activity, Sir Archibald Denny, the chairman, in a short statement to the members, reported that whilst the general work of the Association was in a most healthy condition, the finances, he regretted to say, were not. It could not, of course, be expected that this industrial work would be unaffected by such a devastating cessation of activity as the coal strike, and the Association had done its utmost to introduce still further economies in addition to taking precautions for the immediate future.

He regretted that on March 31st last the Association had to face a total deficit of just over £2,500. This implied that for the time being, at any rate, they could not give effect to the expansion which should, and would, naturally take place if the necessary funds were at their disposal. With the help, however, of the Ways and Means Committee, the needs of the Association were being more prominently and more systematically brought to the notice of the many firms, public supply authorities, and others who did not as yet subscribe to this national work. The scheme of membership which was mentioned last year had been put into operation, and was proving moderately successful, there being now some 600 members enrolled.

The work of the various sections is being maintained, attention being concentrated on the more important inquiries. One of the sections of more than ordinary interest at the moment is the colliery section, the work of which is financed by the coal owners. It will be remembered that in the report of the Royal Commission it was stated that the work which the Mining Association had recently set out to do, under the ægis of the B.E.S.A., was perhaps the most important general inquiry in which the industry had in recent times been engaged, and it should yield valuable gains in efficiency and economy. Amongst other matters, the question of the reduction in the number of varying types of rails in the coal mines has been the subject of a most elaborate inquiry, resulting ultimately in a recommendation to reduce the present 38 sizes, with 12 or more sections, down to a total of 14. With the gradual adoption of these British standards throughout the coalfields, large economies are bound to result.

The question of international collaboration in standardisation work has recently come under the consideration of the Association, and the situation is being carefully explored.

With the revival of trade and greater Government support which this national work undoubtedly merits, the Association should once again be in a position to carry forward with renewed energy the development of this industrial standardisation, the benefits of which extend to the whole Empire.

A Cable Trenching Suggestion.—The accompanying illustration shows a draining excavator in operation during a series of tests undertaken by the Ministry of Agriculture, in co-operation with county authorities, according to the *Journal* of the Ministry, in the work of mole-draining pasture land. The

A Trench-cutting Machine.

excavator is drawn by an efficient and powerful tractor, the wheels of which are well straked. It has been suggested that the same kind of apparatus might be usefully employed for cable trenching where mains have to be laid over considerable stretches of open country; such apparatus, as we have recorded, has been used in Canada, and the method is well worth the consideration of those interested in cable laying.

Varnish Manufacturers' Research.—The secretary of the Department of Scientific and Industrial Research announces that a licence, under Section 20 of the Companies (Consolidation) Act, 1908, has been issued by the Board of Trade to the Research Association of British Paint, Colour and Varnish Manufacturers. This Association has been approved by the Department as complying with the conditions laid down in the Government scheme for the encouragement of industrial research.

Educational.—UNIVERSITY OF LONDON, UNIVERSITY COLLEGE.—We have received a copy of the calendar for the current session. Detailed information as to the history of the college and its arrangements, its various faculties, courses of study, scholarships, &c., are contained in some clxxx+475 pages. The Dean of the Faculty of Engineering is Prof. E. G. Coker; the members of the electrical engineering staff include: Mr. W. C. Clinton, B.Sc., Pender Professor; Prof. J. A. Fleming, M.A., special lecturer in electro-communications; Mr. C. C. Hawkins, M.A.; Mr. H. E. Monteagle Barlow, B.Sc.; and Mr. R. R. Poole, B.Sc.

Railway Electrification Consultants' Fees.—The *Sun* states that the Auditor-General of Victoria reported in October that the fees and out-of-pocket expenses paid to Mr. C. H. Merz in connection with the planning and supervising of the Melbourne suburban railway electrification scheme amounted to £221,168. It was pointed out that the work had extended over 14 years, and the total expenditure up to June 30th last was £6,424,167, of which £6,212,913 had been charged to loan funds and the bafance to revenue.

Nobel Prizes.—The Stockholm Academy of Science has decided to divide the 1925 Nobel Prize for Physics between Professor J. Franck, of Göttingen, and Professor G. Hertz, of Halle. The Academy has awarded the Nobel Prize for Physics for 1926 to Professor Jean Perrin, of the Sorbonne.

A Large D.C. Motor.—A motor of 8,000 h.p. has been shipped from the Westinghouse Electric & Manufacturing Company's works at East Pittsburgh, U.S.A., which has a total weight of 625,000 lb. The overall length of the shaft is 26 feet 8 inches, and the frame has an outside diameter of 20 feet. It is capable of developing a maximum output at 40 r.p.m. of 18,300 h.p. The motor obtains its power from a flywheel set which consists of two 3,500-kW, 700-V generators operating at 375 r.p.m. Three 50,000-lb. flywheels are used to equalise peak loads. The set is driven by a 5,000-h.p. induction motor. The overall length of this set is 48 feet 8 inches.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETINGS SECTION.—At the informal meeting on November 8th, Mr. H. T. Young was in the chair when Mr. D. J. Bolton opened a discussion on "The Economics of Lamp Choice." Mr. Bolton said his remarks would traverse the ground covered by his paper recently published in the I.E.E. *Journal*, and would stress the economics rather than the technicalities in order to urge the case of the ordinary user who wanted to get lumen-hours at a minimum cost. Lamps were different from other parts of an installation in that their existence was for a short period (usually about a thousand hours), while the outlay for renewals was frequent enough to make interest charges compared with depreciation negligible. He therefore proposed the use of lamps in quite an unconventional manner—deliberately over-running when a lamp was large and comparatively less expensive to renew, and under-running or lengthening the life of lamps which were of small size and of relatively high first cost. Three variable factors would then determine the treatment of lamps, *viz.*, their price, their size, and the cost of energy. An abstract of the paper appeared in the ELECTRICAL REVIEW of November 5th. Mr. J. F. Shipley said that the confusion of voltages obtaining to-day compelled a dealer to handle over 1,000 different kinds of lamps, and the proposals of the opener would add still further complications. Mr. A. F. Harmer and other speakers pointed out that yet another variable was the variation from the declared voltage of the supply. The bold interlinking of systems projected under the Bill at present before Parliament might introduce even greater variations of the declared voltage. Messrs. A. Barraclough, J. R. Bedford, J. T. Bedford, W. J. Jones, W. H. Lawes, W. E. Rogers, G. H. Wilson, and H. T. Young also spoke.

North-Midland Centre.—The report of the committee for the 1925-26 session shows that the average attendance at the seven committee meetings was 13, and that at the nine ordinary meetings was 57. The total membership is 532, and the expenses of the session amounted to £431, which sum includes £103 allocated to the Sheffield Sub-Centre and the Students' Section's total of £24.

Sheffield Sub-Centre.—At the eight committee meetings the average attendance was 10, and at the six ordinary meetings 50.

Students Section.—During the session 16 meetings, visits, &c., took place.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

The Tunbridge Wells Town Council has increased the salary of Mr. J. E. POWNALL, chief assistant at the electricity works, from £525 per annum to £605, and that of Mr. R. A. C. BALDWIN, shift engineer, from £254 per annum to £307.

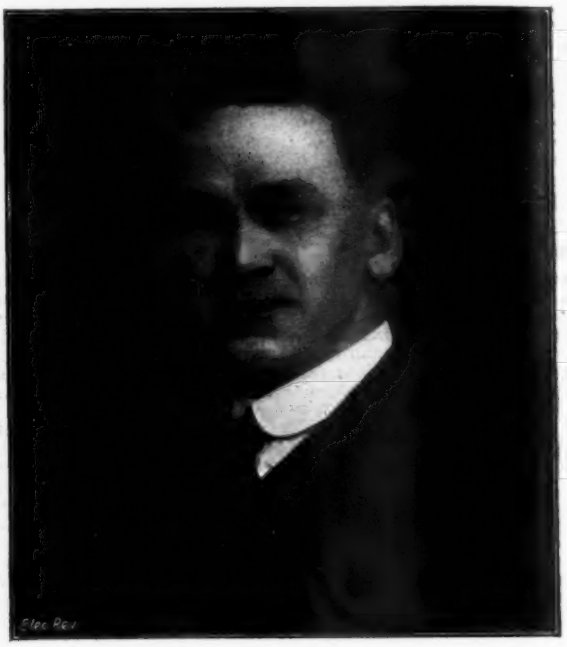
Mr. W. F. SIMPSON, of Messrs. Simpson Bros. of Hapton, Ltd., of Hapton, near Burnley, who first visited Mr. Edison's works at Menlo Park in the year 1881, was recently received again by Mr. Edison and given an interview on the strength of his visit of 45 years ago. Mr. Edison, who presented Mr. Simpson with a signed photograph of himself, is still hard at work, chemistry being now the principal subject of his investigations.

On his retirement from the post of rolling stock superintendent of Sunderland Corporation tramways, Mr. GEORGE HASWELL has been presented with a rest chair and a smoker's cabinet by the staff.

The Burnley Board of Guardians has increased the salary of Mr. SNOWDEN, electrician at Primrose Bank Institution, from £260 to £286 per annum.

The marriage took place at Whitby on November 3rd of Mr. HAROLD BARRATT, of Barratt Bros., electrical engineers, of Baxtergate, Whitby, and Miss GLADYS BLEWETT.

MR. W. G. HEATH, whose portrait is reproduced herewith, is this session's chairman of the Western Centre of the Institution of Electrical Engineers. He was born in Kensington in 1878 and educated at the Plymouth Science and Technical Schools. He served his apprenticeship with a Plymouth electrical and mechanical engineering company, Messrs. Corse and Co., Ltd. In 1900 Mr. Heath commenced business in Plymouth upon his own account as an electrical and mechanical engineer, and this still exists as W. G. Heath and Co. His original staff numbered six, and he now employs between 80 and 100 persons. During the war Mr. Heath took up the work of making munitions and aeroplane engine parts with girl labour. His work as a contractor has included the provision of complete generating stations and equipment for small towns in Devon and Cornwall; he has also carried out important Admiralty and War Office contracts. Mr.

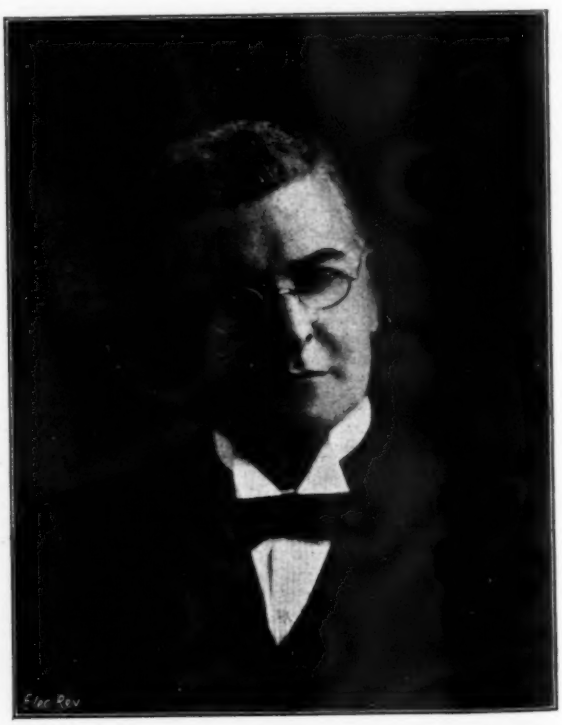


Elliott & Fry] [*London.*

Mr. W. G. Heath,
Chairman, Western Centre, I.E.E.

Heath became an Associate member of the Institution in 1913, and has served for some time on the committee of the Western Centre.

The accompanying portrait is that of MR. WILFRID L. WINNING, chairman of the Scottish Centre of Electrical Engineers. Mr. Winning was born in 1878 and



Lafayette] [*Glasgow.*

Mr. Wilfrid L. Winning,
Chairman, Scottish Centre, I.E.E.

served a mechanical engineering apprenticeship at Messrs. Fishers, Ltd., Paisley. Afterwards he was for a year with the Paisley Corporation Electricity Department as switchboard attendant and assistant mains engineer, and during the following year joined the Glasgow Corporation Tramway Department as assistant mains engineer. He was there

during the period of changing over from horse to electric traction (1900-1901). Later Mr. Winning became charge electrician at the Pinkston station of the Glasgow Tramways. After serving two years in this capacity he joined the British Westinghouse Co. as erecting engineer, and shortly afterwards was appointed sales engineer (Glasgow area) to the company, a position which he held for 12 years. He went to the Electric Construction Co., Ltd., in 1918, and since that time has had charge of that company's interests in Scotland. Mr. Winning is a prominent Freemason.

Councillor H. K. BEALE has been re-elected chairman of the Birmingham Electric Supply Committee.

The Sunderland Town Council has decided that Mr. W. A. ROYLE shall be designated assistant manager of the Corporation electricity undertaking and his salary has been fixed at £700 per annum, an advance of £65, upon a " cost of living " scale. The title of the present chief assistant of the undertaking is to be altered to chief assistant engineer.

Indian Engineering states that on return from leave Mr. F. O. J. ROOSE, M.I.E.E., F.C.S., was appointed electrical engineer to the Government of Bombay.

The *Review of the River Plate* reports that Mr. G. FRENCH STEHELIN was presented with an inscribed silver table centrepiece on October 14th upon his retirement from the position of Buenos Aires superintendent of the Western Telegraph Co.

Mr. T. HADFIELD, of the technical staff of the British Insulated Cables, Ltd., Helsby, on Saturday sailed for America to take up a position at Minneapolis. Presentations were made at the works last week.

Obituary.—MR. E. F. MOY.—We regret to announce that Mr. Ernest F. Moy, managing director of the company bearing his name, died on November 9th. The funeral took place at

The Late Mr. E. F. Moy.

Richmond Cemetery on Saturday last. Although he was one of the pioneers of the electrical industry, Mr. Moy was only 57 years of age. His connection with the industry commenced when he was about 16 years of age. Then, in spite of his youth, he was placed in charge of the plant and lighting at the old Her Majesty's Theatre, Haymarket, one of the first electrically-lighted theatres. At about this period, too, he had charge of one of the circuits of the Pilsen lighting system which supplied a part of Holborn by means of overhead wires. He later became assistant to Mr. Francis Teague (well known for his meter invention) and then helped his uncle in the lighting of Bournemouth. In 1895, in association with Mr. Charles G. Fox, he founded Moy, Ltd. He had met Mr. Fox three years earlier at the old Immisch works, and they remained colleagues until Mr. Moy's death, Mr. Fox being director and secretary of the company. Mr. Moy's instruments and circuit breakers will continue to be a memorial of his abilities. The company has carried out many important contracts, the St. James' & Pall Mall Electric Light Co., Ltd., being one of the principal customers. Apart from his purely electrical side, Mr. Moy was a pioneer in the development and manufacture of kinematograph apparatus, and in this connection his name is known all over the world, especially in the United States. His death was rather sudden; he was at his office on November 8th and was taken ill the following day.

MR. J. MOONEY.—The death is reported of Mr. Joseph Mooney, chairman of the Dublin United Tramways Co., at the age of 75.

New Companies Registered.

Wireless Music, Ltd. (217,393).—Private company. Registered November 8th. Capital, £200 in 200 ordinary and 200 deferred shares of 10s. each. Objects: To adopt agreements (1) with M. E. Elliott, F. A. Andrews and M. D. Lyon; (2) with the said M. E. Elliott; and (3) with the said F. A. Andrews, and to carry on the business of manufacturers of and dealers in apparatus and component parts of all kinds for the transmission and reception of sound and light (whether by radio, photography, or otherwise), &c. The directors are:—M. E. Elliott, The Thistles, Kemp Lane, Beccles, Suffolk; F. A. Andrews, "Low Farm," Darsham, near Yoxford, Suffolk; M. D. Lyon, The Reform Club, Pall Mall, S.W.1; B. H. Lyon, 59, Fitzjohn's Avenue, Hampstead, N.W.3; P. H. Tildsley, Vale Lodge, Vale of Health, Hampstead, N.W.3. Qualification, one share. Secretary: D. C. Robinson. Solicitors: H. W. & S. Patey, 33, Finsbury Square, E.C.2. Registered office: Paul Turpin Works, Oaklands Road, Cricklewood, N.W.2.

Alfred Vernon Power and Engineering Co., Ltd. (217,431).—Private company. Registered November 10th. Capital, £1,000 in £1 shares. Objects: To adopt an agreement with Mrs. M. E. Galvayne and A. E. L. Galvayne for the acquisition of the business of electricians, and dealers in electricity carried on by them at Irby Road, Heswall, Cheshire, as the "Pensby Estate Electric Supply," together with certain lands, buildings, and other property belonging thereto, or used in connection therewith, and to carry on the same and the business of manufacturers of and dealers in wireless instruments, &c. The first directors are:—L. Hylands, Pensby Hall Cottage, Irby Road, Heswall, Cheshire, engineer; T. Bibbey, Thornbury, Freshfield, Lancs., architect; and A. E. L. Galvayne, 31, Alexandra Drive, Sefton Park, Liverpool, estate agent (managing and permanent director). Qualification, £1. Remuneration of managing director, £50 per annum; of other directors, £1 per annum. Secretary: A. E. L. Galvayne. Solicitor: C. B. Taylor, 20, Sir Thomas Street, Liverpool. Registered office: 18, James Street, Liverpool.

Second Electric Supply Corporation, Ltd. (217,411).—Public company. Registered November 9th. Nominal capital, £5,000 in £1 shares. Objects: To carry on in the U.K. or elsewhere the business of an electric light and power company in all its branches. Minimum cash subscription, 500 shares. The first directors are:—J. G. B. Stone, Muir House, Broadwater, near Worthing, director of public company; K. A. Scott Moncrieff, M.I.E.E., The Clough, Oxted, Surrey, engineer; E. H. F. Reeves, Field House, Friern Park, North Finchley, director of public company; J. N. A. Houblon, Boxford, Newbury, Berks., engineer; and Lt.-Col. G. C. Stowell, Glendale, Church Road, Hanwell, secretary. Qualification, £100. Remuneration as fixed by the company. Solicitors: Wilkinson, Bowen, Jackson and Curran, 34, Nicholas Lane, E.C. Registered office: 424, Salisbury House, London Wall, E.C.2.

Compagnie Internationale d'Electricité (F.2,875).—Particulars of this company were filed on November 6th, 1926, pursuant to Section 274 of the Companies (Consolidation) Act. The capital is 100,000 fr. in 100 shares of 1,000 fr. each. The company was incorporated in France on July 28th, 1926, to manufacture and sell electrical devices and lamps, &c. The British address is at Headland House, 308, Gray's Inn Road, W.C.1. I. Meller, of 72, Parkhill Road, Hampstead, N.W., is authorised to accept service of process and notices on behalf of the company. The first directors are Max Weinberger, 375, Prinsengracht, Amsterdam; and Heinz Weinberger, 70, Rue de l'Aqueduc, Paris.

Excelsior Electric Cleaner Co., Ltd. (217,417).—Private company. Registered November 10th. Capital, £5,000 in £1 shares. Objects: To acquire the business now carried on as the "Excelsior Electric Cleaner Co.," to acquire trade mark No. 461,874, registered November 23rd, 1925, in the name of H. E. Chamberlin, known as "Excelsior," and to carry on the business of manufacturers of and dealers in electrical and mechanical vacuum cleaners, &c. The first directors are:—W. Gebbie Lijnboom, Dordrecht, Holland; P. L. van de Polder, Singel 65, Dordrecht, Holland. No qualification necessary. Remuneration as fixed by the company. Solicitors: Stephenson, Harwood and Tatham, 16, Old Broad Street, E.C.2. Registered office: 5, Robert Street, Adelphi, W.C.2.

Tyche, Ltd. (217,412).—Private company. Registered November 9th. Capital, £100 in £1 shares. Objects: To carry on the business of electrical engineers, electricians, electrical and general wiring contractors, manufacturers of and dealers in electrical and radio apparatus, &c. The subscribers (each with one share) are:—S. Wolf, 42, Clifton Gardens, Maida Vale, W.9, electrical engineer; and J. J. Dykes, "St. Swithins," Shortlands, Kent, articled clerk. S. Wolf is the first and permanent director. Qualification, 1 share. Solicitors and registered office: Gordon, Dadds & Co., 175, Piccadilly, W.1.

Ruskington Electric Supply Co., Ltd. (217,423).—Registered November 10th. Capital, £2,000 in £1 shares (1,500 5 per cent. cumulative preference and 500 ordinary). Objects: To carry on the business of an electric light company in all its branches. Minimum cash subscription, £7. The directors are:—F. B. C. R. Roe, Saffron Garth, Beaumont Fee, Lincoln, electrical engineer; J. B. B. Whelan, The Paddocks, Ruskington, medical doctor; F. C. Gibson-Hill, 127, Oxford Road, Moseley, Birmingham, mechanical engineer; and R. A. MacBrair, "Netherwood," Hamilton Road, Lincoln, civil engineer. F. B. C. R. Roe is permanent. Qualification, £50. Secretary: J. B. B. Whelan.

Graham Amplion, Ltd. (217,419).—Private company. Registered November 10th. Nominal capital, £100,000 in £1 shares (5,000 7 per cent. cumulative preference and 95,000 ordinary). Objects: To adopt an agreement with Alfred Graham and Maria Graham (exors. of the late Edward Alfred Graham) for the acquisition of the business of manufacturers (*inter alia*) of the "Amplion" loud speaker, including amongst other trade marks the registered trade mark "Amplion," No. 408,176, of 1920, and to carry on and extend the business of manufacturers of and dealers in "Amplion" and other loud speakers and certain component parts thereof; motor horns and other apparatus (being a branch of the businesses formerly carried on by the said E. A. Graham as "Alfred Graham & Co." at 25 and 26, Savile Row, Regent Street, W., and elsewhere), and that of manufacturers of gramophones, acoustic instruments, electrical, magnetic, galvanic, and other technical or scientific instruments, &c. The first directors are:—A. Graham, "Irongates," 62, Dacres Road, Forest Hill, S.E.23, electrical engineer; Mrs. M. Graham, "Oakleigh," Southend Road, Beckenham; W. H. Lynas; W. J. Rickets; E. E. Smith; and J. M. Richard, addresses not stated. The first two named may retain office so long as Maria Graham or her executors or administrators hold £50,000 ordinary shares. Qualification of ordinary directors, £10. Remuneration (except managing directors and any director holding any other office or place of profit under the company) as fixed by the company. Secretary: F. A. Philo, 25 and 26, Savile Row, W. Solicitors: Shaen, Roscoe, Massey & Co., 8, Bedford Row, W.C., and 6 and 8, Ludgate Hill, E.C.

Alfred Graham & Co., Ltd. (217,414).—Private company. Registered November 10th. Nominal capital, £40,000 in £1 shares (5,000 7 per cent. cumulative preference and 35,000 ordinary). Objects: To adopt an agreement with A. Graham and Maria Graham (executors of the late E. A. Graham) and to carry on and develop the business of manufacturers of naval and other telephones, electrical apparatus used in connection with wireless loud speakers, and other electrical apparatus, being a branch of the business formerly carried on by the said E. A. Graham, as "Alfred Graham and Co.," at Crofton Park, and at the Kilmorie Works, Catford. The first directors are:—A. Graham and Mrs. H. Graham, addresses as above; E. E. Smith; W. J. Rickets; and A. C. Brockies, addresses not stated. The first

two named may retain office so long as Maria Graham or her executors or administrators hold £25,000 ordinary shares. Qualification of ordinary directors, £100 shares. Remuneration (except managing directors and any director holding any other office or place of profit under the company) as fixed by the company. Secretary: F. A. Philo. Solicitors: Shaen, Roscoe, Massey and Co., addresses as above.

Fuller Accumulator Co. (1926), Ltd. (217,402).—Private company. Registered November 9th. Nominal capital, £50,000 in £1 shares (46,000 "A" ordinary and 4,000 "B" ordinary). Objects: To carry on the business of mechanical and electrical engineers, manufacturers of accumulators and primary batteries, wireless loud speakers and components, manufacturers of and workers in india-rubber and all kinds of rubber goods and fabrics, vulcanite, ebonite and similar commodities for medical, motor-car, sport and household and commercial purposes, welders, smelters, refiners, casters and temperers of metals, manufacturers of and dealers in dynamos, taximeters, and of all accessories to and component parts of automobiles, &c. The first directors are:—L. Fuller, "Sunny Croft," Old Road, Frinton-on-Sea, electrical engineer; G. J. A. Fuller, "Brooklyn," Loughton, electrical engineer; E. W. Sudlow, 358, Cranbrook Road, Ilford, chartered secretary; F. C. Vine, 5, Royal Terrace, Northampton; A. P. Welch, 33, Eastwood Road, Goodmayes, electrical engineer; and H. F. Wynn, "The Chalet," Gidea Park, sales manager. Qualification, £10. Remuneration (except managing director) as fixed by the company. Solicitors: Simmons & Simmons, 1, Threadneedle Street, E.C.2. Registered office: Woodland Works, Chadwell Heath, E.

Official Returns of Electrical Companies.

London Magneto Repairing and Winding Co., Ltd.—Mortgage dated November 2nd, 1926, to secure £2,400, charged on 78, Hampstead Road, St. Pancras. Holders: Portman Chapel Temperance Permanent Benefit Building Society, 14, Orchard Street, Portman Square, W.1.

Gravesend and Northfleet Electric Tramways, Ltd. (69,877).—Capital, £100,000 in £1 shares (20,000 preference and 80,000 ordinary). Return dated July 2nd, 1926. 1,437 preference and 78,563 ordinary shares taken up. £75,000 paid. £5,000 considered as paid. Mortgages and charges, £39,000.

Satisfaction to the extent of £39,235 on October 27th, 1926, of debenture stock created under trust deed dated April 23rd, 1926, securing £40,000.

Radions, Ltd.—First mortgage dated October 26th, 1926, to secure £1,200, charged on freehold and leasehold land and premises, and the company's undertaking and property, present and future, including uncalled capital. Holders: R. Dobson and R. T. Hindley, Mosley Street, Manchester.

Claremont, Johnson & Co., Ltd.—Particulars filed of £3,000 debentures authorised October 22nd, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £2,500.

Stearn Electric Co., Ltd.—Issue on October 20th, 1926, of £2,000 debentures, part of a series already registered.

J. V. Brittain & Co., Ltd.—Debenture dated October 14th, 1926, to secure £1,172, charged on the company's undertaking and property, present and future, including uncalled capital, if any. Holder: G. G. Poppleton, 26, Corporation Street, Birmingham.

Radiax, Ltd.—Particulars filed on October 11th of £750 debentures authorised July 26th, 1926, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £600.

Chambers & Champion, Ltd.—Debenture dated October 29th, 1926, to secure £150, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. E. Mott, 14, King William Street, E.C.4.

Chirk Electricity Supply Co., Ltd. (200,607).—Capital, £5,000 in 10s. shares. Return dated May 22nd, 1926. 6,790 shares taken up. £2,320 10s. paid. £1,074 10s. considered as paid. Mortgages and charges, nil.

Meta Manufacturing Co., Ltd. (200,786).—Capital, £5,000 in £1 shares. Return dated February 26th, 1926. 3,503 shares taken up. £3,500 paid. £3 in arrears. Mortgages and charges, nil. Returns of allotments made up to June 24th, 1926, show a further 1,300 shares allotted for cash.

Dayzite, Ltd. (200,590).—Capital, £5,000 in £1 shares. Return dated September 30th, 1926. 503 shares taken up. £503 paid. Mortgages and charges, nil.

Marconi's Wireless Telegraph Co., Ltd.—Satisfaction to the extent of £75,453 between January 8th and September 8th, 1926, of debenture stock dated November 17th, 1922, securing £1,500,000.

City Notes.

Reports and Meetings of Electrical Companies. Dividend Results, &c.

India Rubber, Gutta Percha, and Telegraph Works Co., Ltd.

The directors' report for the year ended August 31st last shows a profit of £86,721, after providing for taxation and bad debts. To this is added £20,457 brought forward, making £107,178. The preference dividend absorbs £12,500, £35,000 is transferred to the reserve fund, and a dividend of 5 per cent., free of tax, is recommended on the ordinary shares, leaving £22,178 to be carried forward. As was anticipated, the continuance of the coal dispute has had an adverse effect upon the year's results. Notwithstanding this, the business has been well maintained and under less abnormal conditions the trading results would have been much improved. The company's French factory, but for a considerable charge for war tax, which will not recur, would have shown an improvement. An efficient costing system has been instituted at this factory and is expected to materially assist progress. The company's cable steamer *Silvergray* has not been so fully employed and the sales of submarine cable have been less. The reserve fund now stands at £315,000. Meeting, November 25th.

Cape Electric Tramways, Ltd.

The report for the year ended June 30th last records a profit of £77,930, and after providing for debenture interest, &c., and adding the balance brought forward, there is an available balance of £68,085. From this £20,000 is transferred to reserve and £2,500 to the staff benefit fund, and after paying a final dividend of 4 per cent., free of tax (making 7 per cent., free of tax, for the year), a balance of £11,199 is carried forward. The number of passengers carried increased from 31,553,434 to 33,018,481, and the gross receipts from £394,310 to £405,391. The increase in the receipts was more than counterbalanced by the rise in expenditure, due to higher labour charges and track renewals. Arrangements are being made to take the whole of the power requirements for the Cape Town tramways from the Municipality, and satisfactory terms have been arranged with the Port Elizabeth Council for a supplementary supply of power, instead of extending the company's power plant in the town. Meeting: November 24th.

Capitalisation of London Companies' Reserves.

The South Metropolitan Electric Light and Power Co., Ltd., and the South London Electric Supply Corporation, Ltd., have called extraordinary meetings of shareholders for December 9th to pass resolutions increasing their capital by the conversion of reserves. The South Metropolitan Co. intends to raise its capital from £500,000 to £1,100,000, and the South London Corporation proposes to create £440,000 of new capital, making the total £750,000. It is stated that the County of London Electric Supply Co., Ltd., does not intend to increase its capital; it already has £2,445,000 remaining unissued.

A meeting of shareholders of the Chelsea Electricity Supply Co., Ltd., was to be held yesterday (Thursday) to consider resolutions providing for the increasing of the capital to £450,000 by the creation of 50,000 new ordinary shares of £1 each; and to capitalise £148,308 of the undivided profits and distribute it in the form of fully-paid £1 shares to existing ordinary shareholders in the proportion of three new shares for each five held.

International Light and Power Co., Ltd.

At the recent annual London meeting, Sir Frances Voules, C.B.E. (chairman), said that the board could not yet recommend any distribution beyond the preference dividend. The substantial balance which was being carried forward would be required for the development of the various undertakings. During the past year they had experienced certain disappointments in their Caracas subsidiary. Although Mexico had not yet recovered from a series of revolutions, the demand for electricity was growing and persistent, and they felt justified in making substantial additions to the generating plant. The growth of business in Curityba had not fulfilled their expectations, but it was found difficult to cope with the industrial demand. The Parana (Argentina) undertaking had run smoothly. The tramway traffic had exceeded expectations, and the generating plant was fully loaded. £27,500 had been raised on debentures for the development of the undertaking.

Marconi's Wireless Telegraph Co., Ltd.

The financial Press states that a meeting of the unofficial shareholders' committee was held on November 9th, when a statement was issued. It is said that the committee represents 766 shareholders, with an aggregate holding of about £470,000, and the chairman is Mr. C. L. Nordon, LL.B. The Committee has conducted, and is still pursuing, long negotiations with the board, and has propounded a series of questions for inclusion in Sir Gilbert Garnsey's investigation. "At present, however, the Committee have failed to secure any effective voice in the conduct of the inquiry into the causes which have led to the serious losses with which the company is faced, and as to its future directorate and management."

French Companies.—The *Société des Appareils Électriques de Paris et du Rhône* reports gross profits of 2,400,000 fr. for 1925-26, as against 1,381,000 fr .in the previous year. A net balance of 72,000 fr. has been carried forward.

The *Société du Fil Dynamo*, Lyons, reports that the profits increased from 486,000 fr. in 1924-25, to 547,000 fr last year, and the dividend is raised from 20 fr. to 25 fr. per share.

Swiss Companies.—The *Watt Company for Electrical Undertakings*, Glarus, whose share capital a year ago was reduced from 10,000,000 to 3,500,000 fr., proposes to distribute a dividend of 2½ per cent. for 1925-26.

The *Electro-Values Company*, Basle, which has declared a dividend at the rate of 7 per cent. for 1925-26, has decided to increase its share capital from 20,000,000 to 30,000,000 fr. for the purpose of financing new business.

German Companies.—*Brown, Boveri & Co.*, Mannheim, are increasing their capital from £250,000 to £750,000. The new shares have been taken up by a financial group who are offering half of them to existing shareholders at 118 per cent.

Berlin Electric Elevated & Underground Railways Co.—The recent issue in New York of $15,000,000 of this company's 30-year first mortgage 6½ per cent. gold bonds was heavily over-subscribed.

A. J. Stevens & Co. (1914), Ltd.—Speaking at the recent annual meeting, the chairman (Mr. E. E. Lamb) said that there was a severe slump in all sections of the radio trade

in the spring of 1926, but the company took prompt steps to meet the situation. The new receiving sets which they were producing were selling well, but the department, being a comparatively new one, would need careful watching. All the other departments of the company continued their satisfactory progress.

Submarine Cables Trust.—The trustees have issued their report for the period from April 16th to October 31st, 1926. This shows a revenue of £10,309 and an available balance of £9,996. After providing for interest, £8,897 is transferred to redemption fund, and the balance required to redeem the 333 outstanding certificates will be raised by the sale of securities. After the adoption of the accounts, on and after November 18th, the remaining certificates will be redeemed at £120 each, plus accrued interest. The meeting was held on Wednesday last.

Burndept Wireless, Ltd.—At a meeting held on November 10th, the proposal that £50,000 should be borrowed from Messrs. Johnson & Phillips, Ltd., was approved. As we have already reported, the loan will be secured by 8 per cent. debentures. Mr. J. McGregor, managing director of Johnson and Phillips, Ltd., has joined the board, and is to be appointed chairman of the company in succession to Sir C. G. C. Hamilton, who is resigning. Messrs. J. B. Close and J. E. Monins are also resigning from the board.

Northampton Electric Light and Power Co., Ltd.—Last week this company published for general information only particulars of an issue of £286,000 of 5 per cent. debenture stock. This is redeemable at par on July 1st, 1964, or on a winding-up, but the company has the option of redeeming the whole or part on six months' notice on or after July 1st, 1929. The redemption price will be 105 per cent. up to December 31st, 1935, and par thereafter.

Johnson & Phillips, Ltd.—An interim ordinary dividend of 5 per cent., actual, less tax, has been declared. Last year's interim distribution was 7½ per cent. The ordinary capital has, however, been raised from £500,000 to £600,000 during the period. The directors attribute their decision to reduce the dividend to the uncertainty engendered by the coal dispute.

Amazon Telegraph Co., Ltd.—The report for the year ended June 30th last records a gross revenue of £70,684 and a profit, after providing for income tax and debenture interest, &c., of £13,299. To this is added £3,438 brought forward, making £16,737. This is distributed as follows:—General reserve account, £3,000; reserve for renewal and maintenance of cable steamers, £3,000; dividend of 4 per cent.; carried forward £2,737.

Lancashire Electric Light and Power Co., Ltd.—A meeting is to be held on Monday next to consider the increasing of the company's capital to £2,571,415 by the creation of 250,000 7 per cent. cumulative participating preference shares of £1 each. The new capital is required for the financing of the company's developments following upon the opening of the new Padiham station.

Southern Brazil Electric Co., Ltd.—The accounts for the past year show a profit of £335, as compared with a loss of £20,861 in the preceding year. The balance is used to reduce the accrued debit to £48,498. The improved result is attributed to increased currency earnings combined with a rise in the Rio exchange.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Hendon Electric Supply Co.—50,000 new 6 per cent. cumulative preference shares of £1 each, issued at £1 0s. 6d. per share, partly paid and fully paid, Nos. 100,001 to 150,000.

Simms Motor Units.—80,000 shares of £1 each, fully paid, Nos. 120,001 to 200,000.

Adelaide Electric Supply Co., Ltd.—A final dividend of 6 per cent. (actual) has been declared on the ordinary shares, making 12 per cent. for the year, free of British income tax in the case of shares on the London register.

New Issues.—*Adelaide Electric Supply Co., Ltd.*—Applications are being invited from existing shareholders for an issue of 250,000 6½ per cent. "C" cumulative preference shares of £1 each at par.

Perak River Hydro-Electric Power Co., Ltd.—The list was to close on or before to-day (Friday) in an issue of £1,250,000 of 5 per cent. debenture stock, guaranteed by the Government as to principal and interest under the Trade Facilities Acts. Particulars of the company's scheme have already appeared in our pages.

British Electric Traction Co., Ltd.—The directors have declared an interim dividend of 3 per cent. on the 6 per cent. cumulative participating preference shares and one of 3 per cent. on the ordinary stock, as in 1925.

John. I. Thornycroft & Co., Ltd.—The directors have declared a dividend of 3 per cent. on the ordinary shares, and the full 7½ per cent. is to be paid on the preferred ordinary shares.

Electric Construction Co., Ltd.—The directors announce the payment of the interim preference dividend and one at the rate of 6 per cent. per annum on the ordinary shares.

Telephone Manufacturing Co., Ltd.—The company has offered to redeem the 8 per cent. income bonds immediately instead of at December 31st, if holders so desire.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange business during the past week has been influenced by varying hopes and apprehensions which have arisen from hour to hour in connection with the coal position. By the time these notes appear agreement may have been reached. The Stock Exchange has taken for granted for at least a month past that the strike, as it is called, was standing on its last legs. Many improvements have occurred in coal, iron and steel shares. Babcock & Wilcox have participated in this improvement to the extent of a shilling in their price, raising it to 54s. Anticipations in various parts of the House look for brisk markets and rising prices as the immediate effect of settlement, though further consideration of the damage which has been wrought by the dispute is thought likely to lead to a more cautious view being taken after the first glow of satisfaction has spent its force.

The outstanding feature in our price-lists this week is a rise of 4½ points in District ordinary to 58½. Metropolitan Consolidated has sympathised with a gain of 3, to 63, and Underground £1 shares are up to 13s., a gain of 1s. 3d., which is something substantial for them. The board of the Underground Electric Railways was fortified last month by the election of four new directors, upon the strength of whose advent a cluster of rumours arose, directed mainly to the District Company. A little buying pressure disclosed scarcity of stock in the market, and the price has sharply responded. London Electric Railway ordinary stock at 57½, is 2 higher this week.

County of London Electric ordinary have been an active and a strong market, rising at one time to 64s. 3d., in anticipation of the company's announcement in regard to the distribution of its reserves. The official notification which appeared on Monday morning came as something of a damper to the bullishness, because it had been expected that the company would declare its intentions in the same way as the other London companies have done. The County of London occupies a different position, in various aspects, from that held by the remainder of the group, and for this reason meetings have to be called and formalities carried out which may yet, however, be done within the time allowed by the Act, requiring everything to be put in order by the end of this year. The allied companies, South London Electric and South Metropolitan Electric, are in somewhat similar case, and the actual distributions will be announced, it is hoped, within the next five weeks. The Chelsea company is to hold its meeting on Thursday in this week in order to pass the necessary resolutions for the increase of the capital and for the capitalisation of undivided profits for distribution to the ordinary shareholders. It may be recalled that three new shares are to be given for five shares held. Fractional certificates will be issued. Bromptons have gone back to 30s. Of the provincial companies' shares, a 1/16 rise lifted Folkestones to 38s. 9d. New issues are projected by the Hendon Electric and the Lancashire Electric Light & Power Companies.

Something approaching a slump has occurred in Brazilian Tractions, the price shedding 5 points to 108. Other members of the same group are dull. The main selling is said to emanate from Brussels. Anglo-Argentine Tramways debenture has gone back 3 to 71½, a price which allows a yield of 7 per cent. on the money, allowing for the accrued interest in the price. British Columbia Electric stocks are dull. Business was done to-day, Monday, in London United Tramways debenture at 39 and in the £1 preference shares at 2s. 7½d. London and Suburban Traction ordinary changed hands the other day at sixpence, and a bargain was marked last week in Bath Electric Trams preferred ordinary at 4s. 9d. Hastings and District Electric Tramways ordinary occasionally mark around 2s.

Cable and electrical construction shares are a harder market. General Electrics, Brush and Siemens, show advances; the last-named have recovered the interim dividend of 6d. per share. India-Rubber, Gutta-Percha shares remain at 21s. 3d. The dividend for the year is to be 5 per cent., tax free, for the fourth consecutive year. The profit of £86,700 is £21,700 less than that of the previous twelvemonth. Activity continues in Telephone Manufacturing shares, the price of which has risen to 9s., a premium of 1s. 6d. over the figure at which the new shares were offered in the spring, when underwriters received 9¼ per cent. of their obligations. Those who held their shares must be chuckling at the remembrance of the condolences offered them, at that time, on their "bad luck."

Oriental Telephones, after being a steadily-rising market, developed marked strength with a jump of 3s. 9d. to 2 9/16. United River Plates are better at 7 13/16. In the Eastern cable group, Extensions hardened to 18s. 8d. Anglo-American Telegraph preferred failed to recover from its decline to 101.

Amongst interesting new issues is 250,000 Adelaide Electric 6½ per cent. "C" preference shares of £1 each at par. The company's existing 6½ per cents. stand at 21s. 6d., and the 6 per cent. preference at 20s. 6d. The "A" preference, 5 per cent., tax free, are a guinea. The Madras Electric Supply new issue of ordinary shares, of which there are 110,000, is offered at 25s. 6d., entitled to the full final dividend next May. The price of the existing shares was quoted ex the interim dividend last week. Several other companies in this group have new issues in contemplation. The firmness of iron and engineering shares has already been mentioned. Rubber shares are quiet and disposed to heaviness for lack of public interest. Stock Exchange staffs that were working, this time last year, up to 5 a.m., now leave their offices twelve hours earlier.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1924.	1925.	Price Nov.15 1926.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14	14	60/6	—	4 12 7
Brompton Ordinary	1	10	10	1½	—¼	6 13 4
Charing Cross Ordinary	1	15	15	2⅝	—	6 6 4
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	48/3	—	6 4 4
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	15	15	3⅛	—	4 16 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	5	15	15	17	—	4 8 8
Lancs. Light and Power	1	7½	7½	24/-	—	6 5 0
London Electric	1	10	10	35/6	—	5 12 8
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	40/9	—	5 7 10
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary	1	7	7	21/3	—	6 11 9
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	18½	—	4 14 7
South London	1	15	15	2⅝	—	5 14 3
South Metropolitan Pref.	1	7	7	1¼	—	5 12 0
Urban Ordinary	1	4	7	1¼	—	5 12 0
do. 6 % Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	2⅛	—	7 5 5
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

Home Rails.

Central London Ord. Assented	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	63	+3	7 18 8
do. District	,,	3½	3½	58½	+4½	5 19 6
Underground Electric	£1	Nil	Nil	13/-	+1/3	Nil
do. do. Income	Bonds	6	6	101	—	*5 18 10

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	1½	24½	—	6 1 8
Automatic Telephone	1	8	10	2¾	—	8 9 7
Chili Telephone	5	5	6	6¼	—	4 7 4
Cuba Sub. Ord.	10	5	5	7½	—	7 0 4
Eastern Extension	10	10	10	18½	+½	*5 10 4
Eastern Tel. Ord.	Stock	10	10	180	—	*5 11 1
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 6 8
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	9½	10	47½	—	*5 5 10
Marconi	1	10	Nil	⅛	—	... ...
Marconi-Marine	1	10	7½	1⅛	—	6 13 4
Oriental Telephone Ord.	1	12	12	51/3	+⅓	*4 13 8
United R. Plate Tel.	5	8	8	7½	+¼	*5 2 5
Western Telegraph	10	10	10	17½	—	*5 12 8

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	8	—	9 8 4
do. do. 2nd Pref.	5	6	6	2½	—	10 18 4
do. do. 5% Deb.	Stock	5	5	71½	—3	6 19 0
British Electric Traction Ord.	,,	7	8	145	+1½	5 10 4
do. do. 6% Pref.	,,	6	6	110	—	5 9 1
Brazil Traction	100	4	5	109½	—5	4 12 6
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	86½	—	5 15 7
do. do. Preferred	,,	90/-	126/9	115	—	*5 13 1
do. do. Deferred	,,	129/5	8	145	—	*5 10 4
do. do. Deb.	,,	4½	4½	76	—1½	5 11 10
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/-	—	Nil
London United Tram. Deb.	Stock	4	4	40½	—	9 17 6
Mexico Trams, 5% Bonds	—	5	5	60½	—	7 10 5
Mexican Light Common	100	Nil	Nil	86½	—	Nil
do. Pref.	100	Nil	Nil	80	—	Nil
do. 1st Bonds	—	5	5	86½	—	7 10 5
Yorkshire (West Riding)	1	6	—	11/6	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	12	13	54/-	+1/-	4 12 10
British Aluminium Ord.	1	5	10	45/9	—	4 7 5
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	3⅜	—	4 8 11
Brush Ord.	1	10	10	27/-	+9d.	7 6 0
Callenders	1	15	15	3⅜	—	4 12 4
do. 6½% Pref.	1	6¼	6¼	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	12/-	—	... ...
Edison-Swan	4/-	10	10	12/9	—	3 7 7
do. 5% Deb.	Stock	5	5	86	—	5 16 3
Electric Construction	1	10	10	32/-	—	6 5 0
Enfield Cable Pref.	1	7½	7½	1¼	—	6 6 4
English Electric	1	5	Nil	14/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6¼	6¼	24/-	—	5 13 1
do. Ord.	1	5	7½	29/6	+6d.	5 1 3
Henley	1	16	20	4	—	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 0 0
India-Rubber	1	5	5	1⅛	—	*4 14 1
Johnson & Phillips	1	10	17½	56/3xd	—1/6	6 0 2
Met.-Vickers Ord.	1	8	8	23/9	—	6 14 9
do. Pref.	3	8	8	2⅛	—	6 18 4
Siemens Ord.	1	7½	7½	28/9xd	+6d.	5 4 4
Telegraph Construction	12	20	10	29½	—	*4 1 4

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price Nov. 16th.	Fortnight's inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3¼d. to 3¾d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£107 to £112	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/8 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£276	£12 inc.
Grade II	,, ,,	£193	£8 inc.
Grade III	,, ,,	£1o1	£3 inc.
c Brass (rolled metal 2' to 12' basis)	per lb.	10¼d.	...
c ,, Tubes (solid drawn)	,,	1/0 to 1/0¾d.	...
c ,, Wire, basis	,,	10½d.	...
c Copper Tubes (solid drawn)	,,	1/1	...
c ,, Bars (best selected)	per ton.	£92	...
c ,, Sheet	,,	£92	...
c ,, Rod	,,	£92	...
d ,, (Electrolytic) Bars	,,	£86 2s. 6d.	17s 6d. dec.
d ,, ,, Sheets	,,	£144 10s.	...
d ,, ,, Wire Rods	,,	£76 2s 6d.	12s 6d. dec.
d ,, ,, H.C. Wire	per lb.	9¼d.	¼d dec.
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
g German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	8/-	...
h India-rubber, Para fine	,,	1/7½	...
i Iron Pig (Cleveland No. 3.)	per ton.	72/6	...
i ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£30 15s.	5s. dec.
g Mercury	per bot.	£16 10s. to £17	5s. inc.
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2½	...
p ,, ,, wire	,,	1/4	...
e Platinum	per oz.	£23	...
d Silicium Bronze Wire	per lb.	10½d.	...
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£311 10s. to £312	£16 5s. inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Notes from Switzerland.—Current conversation in Swiss electrical-engineering circles naturally turns upon two subjects: the continued menace to the Simplon line, caused by the avalanches of mud and stones between St. Maurice and Evionnaz, and the disaster in the tunnel of Ricken, whereby nine railway-men lost their lives. The latter affair is a striking proof of the danger that attends the use of coal for steam locomotives. Carbonic acid gas was the direct cause of the asphyxiation of the men, and whether or not the ventilation of the tunnel was all that could be desired, the affair affords a very weighty argument for the electrification of *all* railways with long tunnels. The little mountain torrent, St. Barthelemy, which has caused so much harm already to international traffic on the Simplon line, has once more overflowed, and submerged not only the bridge over which runs the main road between St. Maurice and Martigny, but is also threatening the temporary viaduct, erected with great difficulty recently by the electrical engineering staff of the Swiss Federal Railways. All communication, whether by road or rail, is therefore more or less interrupted, and the international expresses are once more sent round from Brigue through the Lötschberg to Berne. Unfortunately the fine weather seems to have broken up and the heavy rain continues to swell the waters of the turbulent little stream, sending down rocks and tree-trunks, and formidable *débris* of all sorts. The telephone has been extremely useful in keeping the workers on the road and line informed as to what was passing in the mountains above Lavey, and the electric searchlights of the forts of St. Maurice have been constantly in use, and have rendered an immense service to the harassed workers on the road and line.

Exports and Imports of Electrical Goods and Machinery in October, 1926.

ALTHOUGH our electrical exports declined in value from £2,084,194 in September to £1,684,842 in October, they were £321,360 above the October, 1925, value. Thus for the first time this year the figure for the completed portion of the year rose above that for the corresponding period of 1925.

The reason for the decrease as compared with September is not far to seek; it was caused by the huge fall in the value of exported submarine cable, which in September reached an abnormal height. Apart from this, the other decreases were comparatively insignificant, although switchboards experienced a drop of £6,609. Increases were general, the most important being in insulated wires and cables (£64,689), unenumerated electrical machinery (£61,980), unenumerated goods and apparatus (£41,116) and non-submarine telegraph and telephone cables (£35,582); other items also showed very large increases. A comparison with the October, 1925, figures reveals a very satisfactory position. All but five items showed rises, and the decreases were not of serious proportions—the largest being a fall of £11,951 in glow lamps. Insulated wires and cables were prominent among the increases with a rise of £124,723, but several other items, such as unenumerated goods and apparatus and non-submarine telegraph and telephone cables, were also well above the previous year's levels.

There was a fairly general increase in imports in comparison with September last, the largest rise occurring in unenumerated electrical machinery, and the result was a net increase of £72,743. On the other hand, the total was £36,826 lower than that for October, 1925, and our already very favourable balance was thus improved. Only one item was greater in value than in the corresponding month of last year (unenumerated electrical machinery, £28,760 increase); all the others were lower, telegraph and telephone apparatus being the most prominent in this respect. There was little worthy of note in the movements of the re-exported goods, although, like the imports, they were higher than in September last, but lower than in October, 1925.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Oct., 1926.	Inc. or dec. as compared with Sept., 1926.	Inc. or dec. as compared with Oct., 1925.	Electrical imports for Oct., 1926.	Inc. or dec. as compared with Sept., 1926.	Inc. or dec. as compared with Oct., 1925.	Electrical re-exports for Oct., 1926.	Inc. or dec. as compared with Sept., 1926.	Inc. or dec. as compared with Oct., 1925.
Electrical goods and apparatus (unenumerated)	£207,515	+ £42,116	+ £48,750	£109,071	+ £13,319	− £7,916	£6,153	+ £1,209	− £2,477
Insulated wires and cables	376,063	− 64,689	+ 124,723	62,474	+ 16,121	− 6,772	2,993	+ 2,430	+ 2,189
Glow lamps	38,596	+ 3,110	− 11,951	32,103	+ 1,733	− 1,578	442	− 30	− 78
Arc lamps and parts	562	+ 17	− 512	2,074	− 7,051	− 1,500	35	+ 23	+ 10
Batteries and accumulators	104,780	+ 25,539	+ 30,673	94,791	+ 16,153	− 1,398	354	− 930	− 1,593
Meters and instruments	31,476	+ 247	− 3,786	13,307	+ 485	− 10,668	480	− 122	− 107
Carbons	1,452	− 27	+ 807	7,703	+ 4,080	− 3,143	477	+ 446	+ 339
Electrical Machinery—									
Electrical machinery (unenumerated)	264,585	+ 61,980	+ 163	91,968	+ 21,735	+ 28,760	4,723	− 1,634	− 2,051
Railway and tramway motors	50,581	+ 27,860	+ 1,172	—	—	—	—	—	—
Other motors and generators	219,091	− 1,179	+ 32,280	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	8,443	− 6,609	− 51	—	—	86	− 353	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	103,302	+ 35,582	+ 57,731	13,531	− 2,944	− 422	—	− 1,778	—
Submarine telegraph and telephone cable	6,602	− 661,908	− 6,191	—	—	1,506	—	—	—	—
Telegraph and telephone instruments and apparatus	266,759	+ 9,231	+ 37,852	49,294	+ 8,677	− 31,836	5,395	+ 734	+ 1,776
Totals	£1,684,842	− £399,352	+ £321,360	£478,716	+ £72,743	− £36,826	£21,052	+ £348	− £1,992
			Exports.			Imports.			Re-exports.
Increase and decreases for ten months of 1926			+ £107,062			− £468,015			− £33,535

The Electrical Imports of Argentina.

THE Argentine Government has recently issued detailed statistics of the country's foreign trade in 1925. The following table shows the values of the various descriptions of electrical materials imported in that year and in 1924, together with a note of increases or decreases. The values are the Argentine Customs Tariff valuations; the gold peso=about 4s.

	Gold Pesos. 1924.	Gold Pesos. 1925.	Inc. or dec.
Clamps or porcelain tubes—			
Total *	16,000	16,000	—
Pushes and electric bells (returned by dozens)—			
Total *	10,000	25,000	+ 15,000
Electric bells (returned by units)—			
Total *	48,000	66,000	+ 18,000
Carbons for arc lamps—			
Total *	11,000	9,000	− 2,000
Electric meters—			
Total	463,000	784,000	+321,000
From Germany	251,000	407,000	+156,000
„ France	35,000	276,000	+241,000
„ United Kingdom	106,000	54,000	− 52,000
Small electric motors for fans, &c.—			
Total	115,000	128,000	+ 13,000
From Germany	50,000	30,000	− 20,000
„ United States	44,000	68,000	+ 24,000
„ United Kingdom	12,000	14,000	+ 2,000
Electric batteries—			
Total	375,000	447,000	+ 72,000
From Germany	58,000	64,000	+ 6,000
„ United States	253,000	338,000	+ 85,000
„ United Kingdom	35,000	25,000	− 10,000
Materials for cells or storage batteries—			
Total	272,000	381,000	+109,000
From Germany	126,000	94,000	− 32,000
„ United States	77,000	175,000	+ 98,000
„ United Kingdom	40,000	50,000	+ 10,000
Porous jars for batteries—			
Total	7,000	11,000	+ 4,000
From United Kingdom	5,000	8,000	+ 3,000
„ France	2,000	3,000	+ 1,000
Glass jars for cells and storage batteries—			
Total	8,000	11,000	+ 3,000
Plugs—			
Total *	8,000	3,000	− 5,000

* Mainly from Germany.

	Gold Pesos. 1924.	Gold Pesos. 1925.	Inc. or dec.
Wall sockets—			
Total *	12,000	12,000	—
Circuit breaking devices, such as "wall fuse sockets"—			
Total	36,000	15,000	− 21,000
From Germany	27,000	9,000	− 18,000
,, United Kingdom ...	4,000	1,000	− 3,000
,, United States ...	2,000	3,000	+ 1,000
Insulating tubes—			
Total	472,000	562,000	+ 90,000
From Germany	200,000	325,000	+125,000
,, United States ...	89,000	70,000	− 19,000
,, United Kingdom ...	169,000	154,000	− 15,000
Lampholders—			
Total	142,000	215,000	+ 73,000
From Germany	124,000	149,000	+ 25,000
,, United States ...	13,000	28,000	+ 15,000
,, United Kingdom ...	3,000	4,000	+ 1,000
Apparatus for radio-telephony—			
Total	416,000	465,000	+ 49,000
From United States ...	258,000	289,000	+ 31,000
,, France	56,000	38,000	− 18,000
,, Germany	44,000	16,000	− 28,000
,, United Kingdom ...	38,000	46,000	+ 8,000
,, Netherlands	11,000	74,000	+ 63,000
Apparatus for radio-telegraphy—			
Total	8,000	7,000	− 1,000
From Germany	6,000	7,000	+ 1,000
Accessories for underground cables—			
Total	156,000	56,000	−100,000
From Germany	14,000	9,000	− 5,000
,, United Kingdom ...	60,000	37,000	− 23,000
,, United States ...	5,000	—	− 5,000
Electrical accessories—			
Total	800,000	751,000	− 49,000
From Germany	229,000	227,000	− 2,000
,, United States ...	93,000	288,000	+195,000
,, United Kingdom ...	385,000	216,000	−169,000
Accumulators—			
Total	117,000	243,000	+126,000
From United States ...	55,000	82,000	+ 27,000
,, United Kingdom ...	52,000	152,000	+100,000
Insulators of earthenware, faience, or porcelain—			
Total	174,000	110,000	− 64,000
From United Kingdom ...	34,000	32,000	− 2,000
,, Germany	132,000	72,000	− 60,000
Glass insulators—			
Total	2,000	800	− 1,200
From United States ...	1,000	200	− 800
,, France	1,000	500	− 500
Wires and cables—			
Total	5,530,000	5,561,000	+ 31,000
From Germany	2,214,000	1,683,000	−531,000
,, United Kingdom ...	2,053,000	2,547,000	+484,000
,, United States ...	436,000	540,000	+104,000
Ammeters and voltmeters—			
Total	94,000	113,000	+ 19,000
From Germany	37,000	23,000	− 14,000
,, United States ...	49,000	81,000	+ 32,000
,, United Kingdom ...	4,000	4,000	—
Telephone apparatus—			
Total	270,000	168,000	−102,000
From Germany	91,000	26,000	− 65,000
,, United States ...	36,000	21,000	− 15,000
,, United Kingdom ...	116,000	42,000	− 74,000

	Gold Pesos. 1924.	Gold Pesos. 1925.	Inc. or dec.
Telephone material—			
Total	31,000	30,000	− 1,000
From Germany	3,000	5,000	+ 2,000
,, United States ...	10,000	15,000	+ 5,000
,, France	2,000	—	− 2,000
Telegraph material—			
Total	45,000	71,000	+ 26,000
From Germany	—	7,000	+ 7,000
,, United Kingdom ...	28,000	59,000	+ 31,000
,, United States ...	14,000	2,000	− 12,000
,, France	2,000	2,000	—
Switchboards—			
Total	34,000	26,000	− 8,000
From Germany	10,000	4,000	− 6,000
,, United States ...	10,000	3,000	− 7,000
,, United Kingdom ...	13,000	15,000	+ 2,000
Switches—			
Total	182,000	148,000	− 34,000
From Germany	117,000	97,000	− 20,000
,, United Kingdom ...	16,000	8,000	− 8,000
,, United States ...	20,000	30,000	+ 10,000
Electric fans—			
Total	58,000	59,000	+ 1,000
From Germany	9,000	4,000	− 5,000
,, United States ...	12,000	36,000	+ 24,000
,, Italy	30,000	5,000	− 25,000
,, United Kingdom ...	5,000	7,000	+ 2,000
Insulating tape—			
Total	114,000	130,000	+ 16,000
From Germany	9,000	10,000	+ 1,000
,, United Kingdom ...	6,000	10,000	+ 4,000
,, United States ...	68,000	95,000	+ 27,000
Commutators (returned by weight)—			
Total	1,000	2,000	+ 1,000
From United Kingdom ...	1,000	1,000	—
Commutators (returned by no.)—			
Total	11,000	11,000	—
From United Kingdom ...	3,000	2,000	− 1,000
,, Sweden	4,000	2,000	− 2,000
,, Belgium	2,000	1,000	− 1,000
Cut-outs, safety fuses, and circuit breakers—			
Total	30,000	29,000	− 1,000
From Germany	16,000	10,000	− 6,000
,, United Kingdom ...	3,000	3,000	—
,, United States ...	8,000	7,000	− 1,000
Electric bell indicators and telephone switchboards—			
Total (all from Germany) ...	7,000	7,000	—
Vulcanised fibre—			
Total	33,000	45,000	+ 12,000
From Germany	5,000	6,000	+ 1,000
,, United Kingdom ...	5,000	18,000	+ 13,000
,, United States ...	22,000	26,000	+ 4,000
Dynamos and motors—			
Total	1,555,000	1,809,000	+254,000
From Germany	717,000	899,000	+182,000
,, United States ...	178,000	204,000	+ 26,000
,, Italy	172,000	135,000	− 37,000
,, United Kingdom ...	223,000	290,000	+ 67,000
Incandescent lamps—			
Total	658,000	439,000	−219,000
From Germany	171,000	102,000	− 69,000
,, Holland	349,000	155,000	−194,000
,, United States ...	44,000	72,000	+ 28,000
,, United Kingdom ...	32,000	34,000	+ 2,000
Electrical material not elsewhere mentioned—			
Total	693,000	733,000	+ 40,000
From Germany	217,000	229,000	+ 12,000
,, United States ...	240,000	263,000	+ 23,000
,, United Kingdom ...	167,000	118,000	− 49,000

The Institution of Fuel Economy Engineers.

Pulverised Fuel for Steam Boilers.—The "Atritor Unit" System.

At a meeting of the Institution of Fuel Economy Engineers in London, on November 5th, Mr. R. Jackson, of Coventry, read a paper on pulverised coal, with particular reference to the "Unit" system.

Mr. S. B. Donkin presided, and opened the proceedings by drawing attention to two points that appealed to him: First, the possibility of using powdered "Coalite," which, he hoped, could be made in a more or less powdered form, so that the amount of work required to crush it would be reduced to a minimum; secondly, the possibility of using higher air temperatures in furnaces (as the result of the use of powdered fuel) than could be employed with ordinary grates.

Mr. R. Jackson, in his paper, discussed the theoretical advantages derived from burning coal in the form of a superfine powder, and the conditions that should be complied with to obtain good results. He claimed that the position of the present storage, or "Central," system was being very definitely challenged by the "Unit," or self-contained, mill, which was claimed to combine all the various operations within the compass of a single machine. It was, he said, now entirely reliable and dependable, and would operate for long periods without stoppage. The "Unit" system could be used for small and large installations, units now being available of capacities up to 5 tons of coal per hour. As showing that the capital cost of the "Atritor Unit" system was considerably lower than the storage system, the author gave the following comparative summary of the plant involved in each case:—

Storage system.—Raw coal bunker, cyclone separators and piping, coal dryer and motor, transporter for pulverised fuel, fan for dryer, pulverised coal bunker, conveyor to pulveriser.

feeder screws and motors, pulverising mill and motor, feeder fans and motors, exhausting fan for pulveriser, pipework to burners, burners, &c.

"*Atritor Unit*" *system.*—Raw coal bunker, Atritor pulveriser and motor, fan for secondary air and motor (when required), pipework to burners, and burners.

The "Unit" pulveriser could be easily accommodated on the firing platform of a boiler house, or adjacent to any furnace, requiring no special buildings or foundations, and, therefore, the total cost of installation was a fraction of that of the storage system. The system could be entirely duplicated when necessary, and in many boiler installations it was usual to apply two units, each capable of carrying from 60 to 70 per cent. of the boiler load; by adopting this method, renewals could be effected in an hour at a period of reduced load. Operating costs were much lower than for the "Central" type, and no special staff was required, whilst from the point of view of maintenance costs the "Unit" system would compare most favourably with "Central" plant.

The "Atritor Unit" could deal with coals containing up to 15 per cent. moisture by using hot air drawn from cavities in the furnace walls, and drying them during the pulverising process down to 4 per cent., or thereabouts; separate coal dryers were required with "Unit" mills, however, in exceptional cases. The "Atritor" would pulverise with a power expenditure of from 9 to 15 kWh per ton of coal, depending on the nature of the coal and the degree of fineness required. Dr. Lulofs, of Amsterdam, had proved that boiler efficiencies of over 90 per cent. could be obtained with the "Unit" system.

Discussion.

The Chairman, Mr. S. B. DONKIN, urged the importance of considering carefully initial costs, cost of repairs and maintenance, and power consumption, before the installation of a powdered-fuel system. In every case of recent years one had had to cast the figures up and to find out whether the extra capital charges, as compared with ordinary stoking plant, plus extra repairs and maintenance, plus the extra power required, would represent less than the saving due to the increased efficiency, plus, perhaps, some saving in labour. Some of the results given in the paper indicated that the author must have been reasonably successful in obtaining the advantage, though not in every case. The efficiency obtained at Amsterdam was said to be 90 per cent., but he had not seen it stated whether or not that allowed for the power taken by the auxiliary plant. Assuming that it did not, and that about 12 kWh of electricity per ton of coal burnt was used, that power might represent something over 1 per cent. on boiler efficiency, so that it could be said that the comparative efficiency of the plant was somewhere about 89 per cent. Provided the capital cost and maintenance charges were not too high, it might be a paying proposition. They had in London a stoker-fired plant giving a relative over-all efficiency, including the power taken by fans and stokers, of 86½ per cent. With stoker-fired plant they could obtain a weekly efficiency, including banking losses, of 79 per cent. An efficiency of 92.7 per cent. was claimed recently for plant at Hell Gate, in America, but perhaps that needed some confirmation. He mentioned those points to indicate the difficulty experienced in making out a convincing case for boards of directors for pulverised fuel at the present time. The author was perhaps going a little too far in his statement that steam dryers were the fashion; they were really adjuncts to waste-heat dryers in England where moisture exceeded 10 per cent. He gathered from the author's remarks that such steam dryers were not required; if that were so, so much the better. He had been told that in a steam dryer dealing with coal having about 20 per cent. moisture, 3 per cent. of the total steam generated might be required for use in the dryers as an average, which meant a reduction in boiler efficiency of roughly 2½ per cent.

Mr. G. W. GRIFFIN did not agree that the "Unit" was essentially a high-speed machine, because there were one or two mills which were comparatively slow. He asked for more information about the wear and working life of "Unit" machines. With regard to the emission of ash, he considered it best for those concerned with pulverised-fuel systems to ignore it altogether; it was no use saying that the ash emitted from the chimney would be blown away, because somebody was bound to get it. Finally, he urged the necessity for using the plant best suited to local conditions, and disagreed that the "Unit" system would supersede the "Central" system generally.

Mr. A. SPYER said that the construction of mechanical stokers had reached a stage at which almost any available fuel could be burnt on them, and it was a question whether the claims made on behalf of pulverised coal, *i.e.*, that the range of fuels that could be dealt with was being increased, could be maintained. With regard to the claim that the burning of very inferior fuels could be effected only by pulverising them (which, as a matter of fact, he contested) he pointed out that the cost of dealing with ash when inferior fuels were burnt was becoming a very serious factor. Pulverised fuel had to be regarded at the moment as being on trial, and until its economic and commercial success had been established they must all "go rather slow."

Mr. H. A. S. GOTHARD said that the emission of ash from chimneys when pulverised-fuel systems were used was likely to be more important than smoke pollution. In the very low-grade fuels the ash content was probably about 40 per cent., and he understood that as much as 88 per cent. of the original ash in the coal was emitted.

Mr. E. W. LOWDEN was surprised that the author had concerned himself mainly with drawing a distinction between two systems for the use of pulverised fuel rather than between pulverised fuel generally and mechanical stoking. It was generally understood that mechanical-stoking interests were antagonistic to pulverised-fuel interests, but that, in his view, was quite a mistake. The mechanical-stoker people looked upon the pulverised-fuel systems as potential competitors, but not dangerous competitors at the moment, and he wanted to see the results of further work before he would condemn, or say anything in favour of, pulverised-fuel systems. Some engineers had been led away by the "exuberant verbosity of some of the American boosters," but he was afraid they would have a lot of trouble. In his own practical experience he had had only two instances of comparative tests made between up-to-date mechanical-stoker firing and up-to-date pulverised-fuel firing, and in both cases the mechanical-stoker plant gave better results, both in efficiency and duty.

Mr. W. F. GOODRICH was glad the author had had the temerity to compare the "Central" and "Unit" pulverisation systems, because if there were no other system than the "Central," the use of pulverised fuel would make precious little headway. Unless there were "Unit" systems which could be made in comparatively small sizes, there could be no real future for the use of pulverised fuel in this or any other country. "Unit" pulverisers had been made in the United States and Germany up to a capacity of 20 tons, but he understood they had been complete failures mainly because of their size, and it was being found impossible properly to control the air or the delivery of fuel. The ash problem must be dealt with quickly, inasmuch as the future of pulverised-fuel burning was allied to the question of the application of low-grade fuels, according to the advocates of those systems. In the development of such systems in the United States, however, they had given low-grade fuels the go-by to a large extent, and records showed that they were using extremely good fuels with those systems. The same remarks held good in connection with some of the remarkable figures given in connection with the mechanical stoking system at Hell Gate. During the last few months low-grade fuels had had perforce to be used in this country, and as a result it had been demonstrated clearly that the more perfect mechanical stoker of to-day was capable of dealing with such low-grade fuels as would not have been dreamed of four or five years ago. The margin between pulverised-fuel and stoker firing, from the points of view of using low-grade fuels and thermal efficiency had been very considerably reduced, and the pulverised-fuel people would have to look out very sharply indeed for their laurels in the future.

Mr. P. C. POPE asked for information about the wear and tear on the mills when grinding coke, coke breeze, and residual cokes from low-temperature carbonisation processes, as compared with the wear and tear when grinding coal. As an illustration of what an ordinary chain-grate stoker could do, he mentioned the case of a colliery which had sold, during the coal miners' strike, some 34,000 tons of slurry from its washery to electric power stations. That slurry had all passed through a 1/10-in. mesh screen; it contained 25 per cent. of ash and 20 per cent. of water, but the power stations paid 17s. 6d. per ton for it, and burnt it. Finally, he urged that ash emission must be faced seriously, one of the most serious points about it being the fact that the ash was composed largely of silica, which was injurious to health. The Home Office was very particular that the stone dust employed in coal mines to prevent coal-dust explosions should contain no silica, because if one thing was more likely to cause pthisis than anything else it was finely divided silica.

Mr. E. KILBURN SCOTT drew attention to a photograph exhibited by the author, showing a deposit of ash round the top of the chimney. That ash was deposited because the gases came through a narow orifice and spread, which suggested how dust could be caught without very much machinery being required. The Nechells station was recently burning material from the pit mounds, some of which had been in those mounds for 80 years, and contained 6,000 or 7,000 B.th.u. per ton. The dust in the ash from the mechanical-stoker boilers was caught, and, although it contained only 2,000 or 3,000 B.th.u. per ton, it was being mixed with other coal and passed into the pulverised-fuel fired boilers. Mechanical stoker plant, he believed could not do that. The Americans were as straightforward and as anxious to get at the truth as they were, and he advised a study of the serial report on pulverised fuel of the Prime Movers' Committee of the National Electric Light Association, U.S.A., which contained valuable information. It stated, for instance, that the average life of a set of fan blades in the mill exhauster was about six months, equivalent to about 7,750 gross tons of coal; also, it was necessary to build up feeder screws by electric welding about every three months, or after feeding about 950 gross tons of coal.

Mr. J. D. TROUP said that the use of coal of high ash content, for instance, 50 per cent., would mean that two tons would have to be pulverised, as compared with one if there were no ash at all. That meant a bigger capacity plant and high cost, as well as a means of dealing with slag in a furnace. A small coal cleaning-plant in the boiler house might be more economical than the extra cost otherwise involved in the generating plant. He had seen recently coal-

cleaning plant which was nothing but a simple jumping table supplemented with air under pressure.

Mr. R. Jackson, replying to the discussion, was unable to give the running cost of pulverised fuel plants off-hand. As to maintenance, at his works a very small boiler had been running continuously for 3½ years, and the repairs had been very much less than in the case of the stoker-fired boilers alongside. It had not been his intention to make a real comparison between mechanical stokers and pulverised-fuel systems, because stokers had had a very long run and had attained very high efficiency, whereas pulverised-fuel systems were comparatively young and had not yet reached the summit of efficiency. As to the point at which it was justifiable to use a separate dryer, he had found he could handle fuels containing over 15 per cent. moisture, but it depended, of course, upon what the moisture really meant in the fuel. When the coal began to get sticky it was time to consider whether separate dryers should be used, because pastiness of the coal was the limiting feature. He had handled coal with 25 per cent. moisture, and, although he did not recommend it, it was an asset to be able to handle it without a dryer on rare occasions. Most mills rotated at high speed, otherwise their size could not be reduced to reasonable limits; there were a few low-speed mills, but their performance was not particularly well known and they were not altogether successful. The working life of a mill depended on its duty, but he had mills which had run day and night for four months in connection with metallurgical furnaces, where continuity of operation was essential. Tests at his works had shown that the average ash emission was about 25 per cent. At some stations it was very bad, but he believed it would be realised in the near future that the ash from pulverised-fuel fired plant was of value as a base for many things. For instance, at his works a very valuable polishing compound was made, so that it would not pay to discharge the ash. With regard to the size of "Unit" pulverisers, although there was a limitation, they could be duplicated. Owing to the various types of coke existing, it was difficult to state definitely what maintenance cost would be when pulverising coke, but soft cokes were easily pulverised. On the whole, he did not think the maintenance cost when pulverising coke would be more than double the maintenance cost when pulverising coal, but even if it were double it would be justified.

Electricity in Agriculture.

The Treatment of Crops and Animals.

In a recent publication of the Ministry of Agriculture and Fisheries, "Research and the Land," by Mr. V. E. Wilkins, B.Sc., "Assistant Principal" to the Ministry (H.M. Stationery Office; price 2s. 6d. net), the author deals briefly with the research work which is being carried out by the Ministry in connection with the use of electricity by the farmer. We learn that in the application of electricity to crops, electro-culture experiments are rapidly reaching the stage at which economic conclusions can be drawn. Ten years ago, the work had two broad aspects, large-scale field experiments with growing crops, and more precise investigations on plants growing in pots, and on single seedlings. The field experiments have demonstrated that an average increase in yield of 22 per cent. may be obtained by applying an electrical discharge to spring-sown oats and barley, and the effect on clover-hay seems also beneficial. The laboratory work on pot plants and growing seedlings is continually revealing new possibilities, and it has shown how much there is still to be discovered on such points as the ideal strength of current, and the best periods at which to apply it. The field experiments have recently been suspended until more precise knowledge on the many open questions can be obtained in the pot trials. These trials are being carried out both at South Kensington and Rothamsted; the apparatus involved is extensive, and the pots are sufficiently large to make the results of definite practical value.

It has been ascertained that it is better to apply the electricity during the second month in the growing period of the crop than throughout the season. It has also been shown that the high voltages hitherto used in the field, such as 50,000 V, are not necessary. Results have been obtained, for example, with voltages as low as 1,000 and 200. Another interesting discovery is that the treatment is capable of increasing the grain at the expense of the straw; the discharge seems to stimulate the efficiency of the plant as a grain producer. This is all to the good, for a farmer looks first to the grain, and tall straw may be a positive disadvantage, as it leads to lodging. In the seedling work there is some evidence of an after-effect on growth, subsequent to the discharge, and this is being followed up to find how long the after-effect lasts, and hence whether an intermittent current might be preferable to a continuous one.

One of the difficulties in investigating the minimum strength of current to be applied is that plants are always getting a certain amount of electricity from the atmosphere. Experiment indicates that this normal air-earth current may have some slight stimulating effect, and research has been started at Cambridge to determine the extent to which the current varies throughout the season. Simultaneously the workers at South Kensington are studying the effect on growth of air of which the electrical conductivity has been artificially increased. It will then be possible to ascertain precisely what stimulus the plant receives in the normal way through the electricity that is present in the atmosphere.

Another important line of investigation which has already given results of extreme promise relates to the influence of ultra-violet rays on the bodily activities and health of animals. The most interesting results so far obtained indicate that if an animal's ration is ill-balanced with regard to minerals, the irradiation of the animal with ultra-violet rays for a certain period every day has a definite effect on the rate at which different minerals are absorbed. If the ration is suitably balanced, no effect is observed. This tends to show that irradiation may help to overcome a deficiency in the ration, or, alternatively, may influence the vital processes going on within the animal in such a way as to make it better able to adapt itself to the demands of its body for minerals. Another interesting result has been obtained with the milking goat, chosen in order to study the effect of irradiation on milk production; it has been found that irradiation can decrease the net loss of calcium at the height of lactation, or even turn a net loss into a net gain.

Ultra-violet irradiation of poultry has already been claimed to be of commercial value, and there seems little doubt that it would be well worth while to make a practical test of the economic value of the irradiation of milk cows during the winter months. It is hoped that tests of this kind with both cows and pigs under practical conditions will be made during the winter of 1926-27. It is not inconceivable that irradiation may ultimately prove of great service when a plentiful supply of electricity becomes available to the stock farmer.

Some particulars of the research carried out in connection with the influence of ultra-violet rays upon the health and growth of farm animals are given in the sixteenth report of the Development Commissioners for the year ended March 31st, 1926 (H.M. Stationery Office; price 3s. net).

Investigations have also been made into the question of the generation of electricity by wind power, and an experimental station was established near Harpenden for this purpose (Electrical Review, June 11th, 1926, p. 885).

Of the observations made the most interesting are those which concern the actual gross output of the mills, storage, and the cost per kWh of the energy available from a given plant. Storage by means of accumulators is necessary in order to cover periods of calm and steady the output. The results obtained by the Institute enable the storage capacity necessary for a given mill to be fairly accurately determined for average wind conditions. Capital expenses will naturally differ according to the size of the plant installed, but when these have been met, the actual working charges are comparatively low.

From a large number of simultaneous observations of output and windspeed, curves for each mill, correlating the two factors, have been compiled, which enable the effect of any change of design to be ascertained at a glance. As a result of the trials it may be concluded that wind-power offers a means of generating electricity for lighting and for small power, which should prove useful and economical in isolated districts where no source of public supply is available.

The Electrical Trades Benevolent Institution.

Annual Festival Dinner—A Record Collection.

One of the most successful of the annual festival dinners of the E.T.B.I. took place on November 10th at the Trocadero Restaurant, London, under the festival presidency of Sir Hugo Hirst, Bt., supported by members of the Committee of Management and the hard-working hon. secretary, Mr. F. B. O. Hawes. Not only was the function largely attended (some 230 members with their ladies and guests attended, as compared with about 150 last year), but also the money collected this season will finally probably be double the largest amount hitherto contributed in any one year.

Sir Hugo Hirst, chairman, following the loyal toast, in proposing the prosperity of the E.T.B.I., explained that in 1914 he accepted the presidency with two objects in view, namely, to help the fund and to find out why such a prosperous industry as the electrical industry had not a fund of more suitable size. The second part of his objective was, however, a failure, because at that time their charity was needed elsewhere. This year he had again accepted office with a twofold aim: he wished to raise the fund and to establish it on a firmer basis. Up to 1919 the average income of the Institution was £1,500 per annum; then a certain Mr. Hirst had raised it to £3,000, and he had now beaten that record. He appealed to those present to help him to get more. What could they do for the future? It was not dignified for the president to go begging year after year, mostly from the same people. Why had they not £100,000? It was mostly their own fault, for they had not made sufficient use of those willing to help. He had a few ideas on the subject which he would be pleased to place before the Committee if he were invited to do so. When commencing his appeal this year (rather late, he regretted, owing to indisposition) he found there was no list of trades, individuals, &c., qualified to subscribe to whom appeals could be sent. He therefore set the "G.E.C. machinery" in motion and dispatched over 14,000 appeals to people whose names were on the company's mailing list, and

he had received over 3,000 responses. The charitable feeling was not greater anywhere than in the electrical industry, but they had not made proper use of it. He had had sent him a pile of invitation cards for the dinner for distribution amongst his friends, but he had been chary of doing that sort of thing, and he was surprised to find that the presidents of the electrical Institutions, Associations, Societies, &c., had not been invited as honorary guests. If those to whom they wished to appeal were classified and rated at the amounts it was judged they could contribute, there should be no difficulty in raising an income of £10,000 yearly. They had been afraid of doing the thing properly for fear of what might be thought of them. The job must be thoroughly organised, and they should find a man to carry out the work, and pay him for doing it if necessary. It was too much to expect the hon. secretary to do it all, for he already did too much. Was it realised that there were people who did not know of the existence of the E.T.B.I. and its objects? Others had provided benefit and welfare facilities for their own employés, and thought they had done enough; but, if they knew of the need they would subscribe £100 instead of their present £10. Sir Hugo appealed to those who might wish to help in the direction he had indicated to come forward. He felt that the sum which had been collected this year could be set as a standard, emphasised the usefulness of regular contributions, mentioned the assistance rendered by the technical Press, and referred to the generous spirit of particular people, including Mr. H. Alabaster's gift of £100 and Mr. Dane Sinclair's "bag of £240." The latter gentleman, in addition to his own and his company's efforts, had collected from his staff, an example which many of them could follow.

Mr. LL. B. ATKINSON said that the chairman had stimulated them to new movement in the management of the Institution. He had meant no reflection on anybody, and they would all benefit thereby. In referring to typical cases in which assistance had been provided, he remarked that men whom they would never expect to be in need of help did need it, and got it too. When they went to the help of a drowning man, they did not stop to inquire about his pedigree and qualifications; the first thing to do was to get him out of the water. The electrical industry was one of the bright spots in this country at the moment, and there were many outside who would wish to help if appealed to by proper organisation.

Mr. R. A. CHATTOCK said the chairman had convinced them that something more must be done. The Institution of Electrical Engineers' Benevolent Fund had grown slowly, too; while he was president of the I.E.E. he had helped to organise that fund somewhat, but even now not enough had been done, and he hoped that what the chairman had said would bear fruit. Most of the larger electricity supply undertakings provided for their employés, but others had not done so, and if appealed to they might assist. They were well able to do so; if they could not start superannuation funds of their own, they might do so through the E.T.B.I.

Sir NEWTON MOORE, M.P., advised all present to take advantage of the chairman's peculiar genius for organisation, and to follow his advice. His position was evidence of his ability.

Sir HUGO HIRST then announced that, so far, the total collected this season amounted to £5,070 (compared with £1,327 in 1925 and £1,598 in 1924) to which sum must be added £1,080 as a result of the dinner (compared with £162 in 1925 and £305 in 1924); but the momentum that had been created would bring in still more, and he thought that £7,000 would probably be the final achievement of this year's effort.

Col. SIMPSON toasted the chairman, who briefly replied.

During the evening the company was entertained with a selection of music and song, and the function terminated with the singing of the National Anthem.

Electrical Standardisation.

The "Quantity Production" of Electrical Apparatus and Plant.

By W. L. WINNING, M.I.E.E.

(*Abstract of Chairman's Address delivered at Glasgow before the* SCOTTISH CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

BAD as the conditions have been for all of us, we electrical people can congratulate ourselves that the state of our industry has been a comparatively happy one during the lean years which have followed the post-war boom period. In displaying tempered optimism and claiming progress under difficult circumstances, I am courting the inevitable comparison with the United States—the consumption of electricity per head of population is so many times greater in that country than at home, the annual *increase* of consumption in America is more than our total annual output, and so on. Such a comparison is as unfair as it is facile; there cannot be reasonable comparison between electrical sales in a country whose coffers are overflowing and in one which may be too poor at the moment to afford ultimate economies.

Necessity did in a year or two during the war period what it would probably have taken many years of peaceful persuasion to accomplish. The reorganisation of manufacturers' existing plant with a view to efficient production, and the laying down of new plant to the same end, became an essential need of the nation. Electrical progress during that period, however, was rightly confined to trades engaged upon the production of war material, but in 1919-20 there was a rapid expansion in other directions. The so-called luxury trades (again with the object of increased production) demanded the electrification of their factories, and the domestic load increased enormously. The lean years came, but with them electricity in the home had become a necessity; the gas exponents had practically given up the fight where street, shop, and house lighting was concerned. All that is reasonable enough, but it still leaves the fact that, even in bad times, the electrification of workshops and mills has continued to a remarkable extent unaccounted for. This, too, is capable of a reasonable explanation.

Given equal financial stability, it soon became evident that those concerns which had electrified were in a better position than the others to secure a share of the restricted volume of business which offered. Manufacturers found it vital that they should produce upon the most economical basis, and those who had not made the change-over turned to electricity as a means of commercial salvation. Affairs commercial and financial were, and are, very delicately balanced. The saving of 10 per cent. of the cost of production decided, and decides, not only whether a particular concern will secure or lose an order, but whether the order be placed at all. The higher efficiency provided by electrical driving, therefore, has frequently had a direct bearing upon national and world-wide progress.

Now, if the electrical industry has proved to be the means to an end for others, it has to look to its own production costs to enable it to do so; the concerns which propose to electrify must be provided with apparatus of high efficiency and reliability at low cost. The electrical designer and works organiser have had to scheme and contrive with these ends in view, which collaboration has resulted in standardisation and "quantity production," but do not let the expression "quantity production" be misunderstood. We do not want the electrical manufacturer to say: "Here is the last word in electrical design"; but we are gratified that he is able to say: "Here is the *latest* in electrical design, so satisfactory that (in a given size) an electrical motor, or piece of control gear, built to this pattern is the best possible proposition for 99 per cent. of the jobs that are going." Standardisation to this extent is now adopted by every responsible manufacturer. Many parts of, say, motors are made in hundreds, many of them upon automatic machines, so that when an order is passed to the shops it is possible to draw most parts from stock, and the processes which remain to be carried out at the time the order is received are, therefore, few. All this reacts in favour of the buyer, and encourages trade by cheapening the cost by quantity production and shortening the time required for delivery. The movement towards the standardisation of electricity supply allows the manufacturer to go a step further, and it is now possible for him to stock complete machines and control gear for the more common pressures.

A departure from the standard at the instance of the buyer increases the cost in several ways. Whichever method is adopted (that of enhancing the charges to be added to the cost of special work, or that of averaging upon the whole of the output) the actual results of a year's trading, assuming full output from the factory, are governed by the proportion of standard and special work undertaken during that period. Why do so many people take, say, six months to build a factory, three months to equip it mechanically, and then want all electrical gear built and installed in three weeks? I have no quarrel with the consulting engineer. I am not sure, however, that when he specifies manufacturing details (such as the size of a bearing, or the precise composition of coil insulation) he quite realises what may be involved in the way of factory disorganisation and increased cost, not only to the particular customer concerned, but ultimately to consumers generally. The time when manufacture was very much a rule-of-thumb affair has passed, and the consulting engineer, therefore, if he has at heart, not only the interests of his client, but also the welfare of the industry by which he lives, will confine himself to the specification of duties and performance; he can always demand that a detailed specification be sent with each tender, and any tender from a manufacturer to whose standard practice he is definitely opposed can be ruled out.

I do not want it to be thought that manufacturers of

electrical gear have reached a cut-and-dried policy as regards design and manufacture. In some cases a considerable increase in cost may be justified; for example, mining electrical gear. The Board of Trade has not been too clear, or helpful, in specifying its requirements in this respect; the interpretation of its rules might well be widely different in the minds of its own individual inspectors. Manufacturers have taken matters largely into their own hands, for they realised long ago that, if electricity below-ground is to take its place in anything like fulness, they must satisfy not only the Board of Trade and its inspectors, but, above all, mine managers and engineers themselves.

It is of the greatest importance that there should be a continuance of the reduction of cost of this "comparatively expensive" gear. It is a platitude that for the sake of that industry itself, and of all others dependent upon it, the cost of coal-getting must be reduced. It seems, therefore, that it is for the electrical manufacturer, taking his courage in both hands, to anticipate the increased demand, and to fix his prices of mining gear upon the assumption of quantity production; by these means he will be fulfilling what, at the present juncture, seems to be peculiarly his mission, namely, to make things smooth for other industries, and at the same time pave the way to a lucrative turn-over in this particular branch of his activities.

I am fully aware that there are many classes of electrical machinery and apparatus which, by their size or special applications, preclude standardisation. Work of this kind must be dealt with separately without interference with standard lines.

Britain is, and must continue to be, a manufacturing country: she must export her manufactures to pay for the imports which she is bound to receive; but the first business of the electrical trade must be to assist other industries to carry out this work; therefore the backbone of our particular industry will, for a long time ahead, be in the home market. Therein, so far as electrical machinery and corresponding switching apparatus are concerned, we have an almost clear field; the import of such goods is practically negligible. Our task, therefore, is to improve production and cheapen prices, not to meet foreign competition in our own particular line, but to help other industries to do so in theirs. However, our own export trade should not be neglected. Competition abroad is extremely severe, but, obviously, if "quantity" manufacture on scientific lines will cheapen the production of our wares at home, we shall be in a better position to meet competition abroad.

To sum up, I have endeavoured to show that, almost alone amongst British industries, the electrical trade has benefited by all three phases of the past twelve years. The war taught the world (including ourselves) what we could do; "Peace" permitted an extension of our operations into avenues which were closed by the war, but which, except for the latter, might have remained unexplored for many years; the "slump" called us in as an absolute necessity. I believe a fourth phase is to follow, unlike any of the other three. It will, I think, provide sufficient work for all of us, but only at the restricted prices which will be rendered permissible by a steady output upon standardised lines. The condition of delicate financial poise will continue, so that only by the operation of restricted prices will buyers in other industries be able to take full advantage of electrical economies.

The Universal Application of Electricity.

Domestic Requirements—Cost of Apparatus and Standardisation—Apprenticeship.

By W. G. HEATH, M.I.E.E.

(*Abstract of Chairman's address delivered at Bristol before the* WESTERN CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

UPPERMOST in all our minds to-day is that which is summed up in the phrase "Lighting the Homes of Britain." That great task is essentially the contractor's job. I am very glad the Electricity Commissioner's appointed a Committee to investigate the vital matter of tariff for domestic requirements. In non-industrial areas the use of electricity for domestic purposes, other than pure lighting, has not been pushed far enough; the causes of this lack of progress are: (*b*) The high price per kWh; (*c*) the high cost of material; and (*d*) national conservatism.

High Cost.—The price of domestic power and heating is far too high, largely due to the fact that managers of municipal electricity undertakings fear that if they reduce their tariffs they will have bad balance sheets and members of the Electricity Committees will be unable to plume themselves, when they seek re-election, on the Electricity Departments having contributed large sums in relief of the rates. This attitude is entirely wrong, and the essence of short-sightedness. If there is a profit on the supply of electricity (I speak, of course, largely of municipal undertakings) surely it should, until the consumption reaches, say, 250 per head of the population, be devoted partly to the reduction of tariff and partly to the extension of the undertaking.

The cost of domestic electrical appliances is far too high, and I should like to see each and every Electricity Supply Department empowered to let out on hire such items as electric geysers, heaters, washers, and refrigerators, for that would undoubtedly encourage users. Let us look forward to the time when electricity authorities will be content to split up the financial charges associated with the hire, maintenance, and depreciation of such domestic appliances by debiting one half of such charges to the apparatus and the other half to the charge per kWh. The obstacle of national conservatism does not exist to the extent that is commonly supposed.

In spite of numerous regulations, an enormous amount of jerry installation work is being carried out to-day. What is the remedy? My counsel is to allow only installations that have been carried out by registered contractors with British materials to be connected to the mains. Something more than a "Megger" test in the consumer's cellar is essential if we want increasing and satisfied consumers.

With regard to the damaging reports that many of the recent country-house and other fires have been caused electrically, I suggest that no wiring (whatever system it may be) should be buried under floors or in walls; I see no reason why the job should be an eyesore. In passing, it should not be possible for an electric iron to burn its way through the kitchen table; we have left it to the American manufacturer to put a safety device in the handle.

Standardisation of Apparatus.—In the design of some household appliances there has been too great a tendency to adapt existing forms rather than produce something in which the advantages of electricity would be fully used. This Institution should investigate the question of absolute interchangeability of all parts of essential apparatus, and the development of standardisation of parts. This subject should not be left at the stage of "main engineering plant"; let us go further into detail and explore the possibility of standard factory, small appliances, and household equipment. Many times, as a nation, we have realised too late that individual action has not been satisfactory when foreign competition has had to be faced; with replacements easily to be had and fixed without skilled labour, there should be a great demand, and resulting stimulus to trade. There would also be, I am sure, a further demand from consumers for articles of modified types, of what I term luxury finish and pattern to suit their particular tastes and fancies.

Labour and Apprentices.—Electricity for everybody is a great ideal, but it will bring vast responsibilities. There will be a great demand for skilled labour, and already we are suffering from the lack of it. Steps must be taken early to train an adequate proportion of our youth to deal with the big increase of electrical work that will arise in the near future.

The electrical contracting industry has insufficient skilled labour at its disposal, and I should very much like to see the system of apprenticeship and technical training improved. In general, the higher-grade schools and other similar educational establishments do not instill into the minds of their pupils the virtues and rewards that come from skilled manual labour, but aim rather to produce youths who are anxious to avoid working with their hands. The inevitable result is that the minor clerical professions are overladen with applicants for work, and skilled labour is neglected.

It is, of course, impossible to draw a strict line of demarcation between manual labour and technical knowledge; they are inseparable, but more attention should be given to really sound practical training. The prevalent system of apprenticeship is full of grave defects. I would like to see our Institution inaugurate some scheme for assisting parents and schoolmasters who are desirous of getting boys placed in our industry. At present many boys are sent as apprentices into the contracting industry under conditions which can only be described as appalling. Many of the contracts under which the boys are engaged are, to my mind, nothing less than fraudulent; boys' parents pay premiums to employers who regard such amounts merely as a definite increase of their capital and profits, and little or no regard is paid to the teaching of the boys. Such employers should be drastically dealt with by law. The tendency has been to neglect consideration of the preliminary, or elementary, education of the prospective apprentice. In order that a really good skilled artisan may be trained, close consideration must be given to the whole of the lad's education and practical training. Elementary education in itself, which ceases at the age of 14, cannot turn out boys fit for the skilled-labour market. In the higher classes of elementary schools the boy can with advantage be given some instruction in elementary science and the fundamentals of technical drawing; then at 12 or 13 years of age he would be ready to enter a "Junior Day Technical School," which would occupy his whole time until the commencement of his appren-

ticeship. Appreciation of the reasons *why* a thing should be done will often suggest to the broadly trained mind the means and methods of doing it, whereas the person who has had a more narrow training and only knows *how* the thing should be done may fail to recognise and appreciate the points which bear strongly, though indirectly, on the subject with which he is dealing. When a boy becomes apprenticed, we should not let him give up his education and simply become a man handling tools. It has been suggested that an ideal apprenticeship is one in which the practical training in the workshops and theoretical schooling progress by means of a "Sandwich" system. These schemes could probably be still further developed in all parts of the country to the advantage of all concerned. Whether the instructions at technical schools and colleges be given by day or evening, there is room for closer co-operation between employers, teachers, and employés in deciding upon the courses, subjects, and methods of instruction; whilst a great deal still remains to be done in the workshops by the careful supervision of apprentices. I feel that the subject of training, in view of the future great developments contemplated, cannot be unduly stressed.

New Electrical Devices, Fittings, and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

Wooden Electric Lighting Fittings.

An extensive range of wooden lighting fittings is made by WOODFYT SALES, LTD., 8, Diana Place, N.W.1. These are illustrated in a catalogue recently issued by the company from which we have selected the examples illustrated as typical of the company's work. Fig. 1 shows an ornamental lantern of somewhat ecclesiastical design. The ornamentation is in

Fig. 1.—A "Woodfyt" Lantern.

Fig. 2.—A Gothic Candelabrum.

ebonised wood and several kinds of glass can be supplied. The other example (fig. 2) is a Gothic candelabrum with three beautifully carved arms, and a spread of 22 in. We consider that the company's products are admirably suited for the lighting of churches, old country houses, and those which are designed on "period" lines, where expense is not too great a consideration. It is only fair to say, however, that a number of cheaper fittings are produced.

Bird Guard Designs.

As a result of the interest created by the article on "Structural Design of Overhead Lines," by Mr. W. E. Poole, which we published in our issue of October 8th, 1926, p. 569, we have received the following particulars of bird guards which are being manufactured in this country.

Fig. 3 shows a design which has been recently developed by MESSRS. ELECTRIC TRANSMISSION, LTD., Culford Works, Kingsbury Road, Dalston, London, N.1, with a view to the provision of an attachment which will not affect the electrical characteristics of the line insulators in wet weather, and which can be fitted to existing or new overhead lines quite independently of the insulators and their supporting spindles. The "crowding out of the poor birds" is effected by the enlarged head of the porcelain guard. This is provided with a shedded surface which, it is claimed, remains dry and maintains the efficiency of the guard in wet weather. Further, the enlarged head enhances the effectiveness of the guard since it increases the distance over which the bird must reach, while the pointed apex and well-rounded surface prevents the bird from using the guard as a first-class perch. Two types of guard are manufactured, one with a single shed for working pressures up to 22 kV, and one with a double shed for pressures above this figure. The guard is provided with a clamp fitting, which is claimed to facilitate attachment to new or existing lines, or, alternatively, the fixing takes the form of a spindle where such is preferred for use on new lines. The advantages claimed for this device are:—Ease of attachment, removal and renewal, without disturbance of other fitments; independence of the size and type of line insulators and spindle; the fixing attachment only is affected by the size of crossarm (the guard itself remains standard); no deterioration under varying climatic conditions; minimum covering of the crossarm and hence reduced risk of corrosion; high, wet and dry, flash-over characteristics (40 kV and 70 kV respectively for the single-shed type); and adaptability for use with outdoor switchgear.

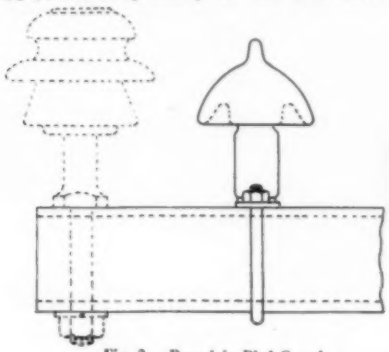


Fig. 3.—Porcelain Bird Guard.

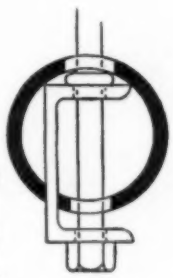


Fig. 4.—Key Fibre Bird Guard.

Fig. 4 illustrates a form of bird guard manufactured by the KEY ENGINEERING CO., LTD., 4, Queen Victoria Street, London, E.C.4. It is constructed from Key Fibre conduit, which is machined to the customer's blue prints. A slot, ¼ in. wide, is cut on the underside of the tube and along its entire length, and this is of sufficient width to enable the guard to be sprung over the crossarm, which is then gripped tightly and no further fixing is required. It is simple, cheap, and quickly installed, and the durability of the material has been proved, it is claimed, by the fact that for more than twenty years between a quarter and half a million feet of the conduit has been stored in the open, exposed to every kind of weather, without any ill effects whatever. In most cases holes are drilled on the upper and under sides for the spindles of the insulators to pass through. Where, however, the insulators are already in position the holes are omitted and the guards are brought close up to, but not under, the insulators upon which they are not dependent in any way for fixing. Tests have been carried out on samples of the conduit 30 in. long, ¼ in. thick, and 3 in. in inside diameter. On three dry samples the average puncture pressure was 29,600 V, and three samples which were soaked for 24 hours before being tested were punctured on an average pressure of 22,900 V.

A New Plug to B.C. Adaptor.

The latest production of MESSRS. A. P. LUNDBERG & SONS, 477 to 489, Liverpool Road, Holloway, London, N.7, is a new insulated pattern of adjustable two-pin plug to B.C. adaptor, fig. 5. It is an improvement on the previous pattern, which had a metal tube for the bayonet socket, in that the socket

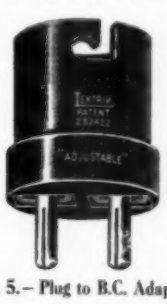


Fig. 5.—Plug to B.C. Adaptor.

Fig. 6.—Pin Assembly Plate.

and base are made wholly of a thick insulating material, "Cosnite," a preparation of the makers with a bakelite constitution. The sliding-contact adjustable-pin feature has been adopted in this new model, and six sizes of pins can be supplied for use with it. An assembly plate, fig. 6, allows each size of pins to be fixed at the correct gauge.

Diesel-Engine Design.

The New Plant for the Shrewsbury Electricity Undertaking.

The considerable advance which has been made in recent years in the design of Diesel oil engines is evidenced by a recent production of Messrs. Belliss & Morcom, Ltd., a 600-b.h.p. air-injection Diesel, which has been built to the order of the Shrewsbury Corporation for installation in its electricity generating station as an extension to two 165-kW sets which were supplied by the same firm some three years ago. The new engine, which is to drive a 400-kW Rees Roturbo d.c. generator, is the result of an effort to increase the engine speed without having an excessively high piston speed, thereby reducing the weight and overall dimensions to more suitable limits as indicated by fig. 1. It is a six-cylinder engine of the single-acting four-stroke type, and the connecting rods and the crankshaft are totally enclosed within a common chamber which, with the rest of the framework, is of cast-iron. The speed of the engine is 350 r.p.m., with a mean piston speed of 990 ft./min.; the stroke is 17 in., and the cylinder diameter 15.5 in. The mechanical efficiency is 74 per cent., and the fuel consumption per b.h.p. 0.41 lb. The total weight of the engine is 40 tons, or 150 lb. per b.h.p., of which the flywheel weighs 3 tons 6 cwt.

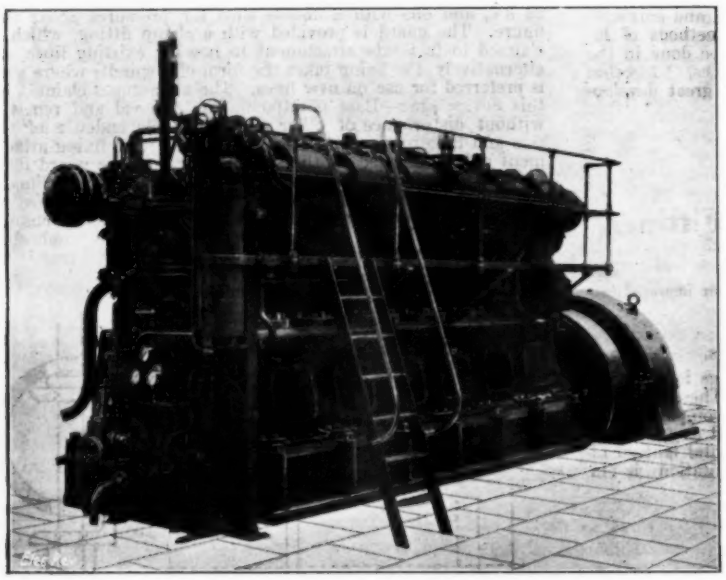


Fig. 1.—600-b.h.p. High-speed Diesel Engine.

As might be expected, the main features responsible for the improved design are the cooling arrangements. There are two cooling systems, water and oil; the former serves the cylinder jackets and heads and the exhaust valves and cases, and the latter the pistons. A small gear-type pump, driven from the main shaft, provides for both the oil cooling and the forced lubrication of all parts of the engine, the oil for lubrication being first passed through an "Auto-clean" filter. The oil for the piston cooling is taken from a main oil-way running along the length of the engine at the bottom of the cylinders by means of a specially constructed pipe, with joints to provide for the reciprocating movement of the piston, and delivered to the piston-head interior at the bottom. The interior of the piston head is of a labyrinth design, with circular ribs, broken at opposite places on adjacent rings, and the oil takes a circuitous path from the outside to the centre, where it is forced up to the piston cover. It is then removed to a tray under the bed-plate chamber by means of a second and similarly connected pipe. The tray is sloped and tapered, and its bottom end is connected to the supply oil tank.

An electrically-driven auxiliary oil pump serves the lubricating system when starting up.

After passing through the oil cooler, the cooling water is delivered to each cylinder jacket at the base. A spiral rib on the jacket interior causes the water to take a circuitous path in flowing to the top of the jacket, where it enters the cylinder cover at three points. At these entrances three tubes direct the water to the centre of the cover, the hottest part. The exhaust valves, both the valve and the cage itself, are water cooled. The water enters and leaves the valve spindle at the top by means of special armoured-hose flexible connections to the supply and return pipes. The construction of the valve is of particular interest. It is hollow at the base, and the space is connected by concentrically arranged inlet and outlet waterways up the spindle, fig. 2; the water enters by the centre tube and leaves by the surrounding outlet. The water supplies to the cylinder jackets and the valves are independently controlled. Another interesting feature in the cooling arrangements is that the main exhaust pipe is water cooled; this has a considerable silencing effect on the exhaust.

The fuel oil is delivered to the cylinder fuel valves by means of six plungers, arranged in two sets of three and driven from the cam shaft. The amount of fuel delivered to the fuel valve in each case is regulated by the quantity by-passed through a suction valve, and governing is effected by varying the amount of fuel by-passed. Hand priming pumps are fitted, and each fuel valve is equipped with a priming valve through which the fuel can be by-passed to ensure that the pipe system is free from air. The pulverisers are of the cross-stream type which, it is claimed, offers less resistance than the ring type.

The air blast system is in accordance with modern Diesel practice. Starting is effected in the usual manner, through a master valve, on three cylinders, and the starting handles are positioned above the cam shaft between the two centre cylinders. The compressor is driven from the main shaft in the usual manner, and is of the three-stage type. The third stage is at the top, and the bottom or second stage is double-acting. Air coolers are provided between stages one and two, and two and three, and also between stage three and the blast bottle. Two large starting bottles are provided, and are charged direct from the blast bottle in the usual manner.

The running of the engine on the test plates at the works of Messrs. Belliss and Morcom, Ltd., may be described as particularly smooth with a conspicuous absence of "knocking."

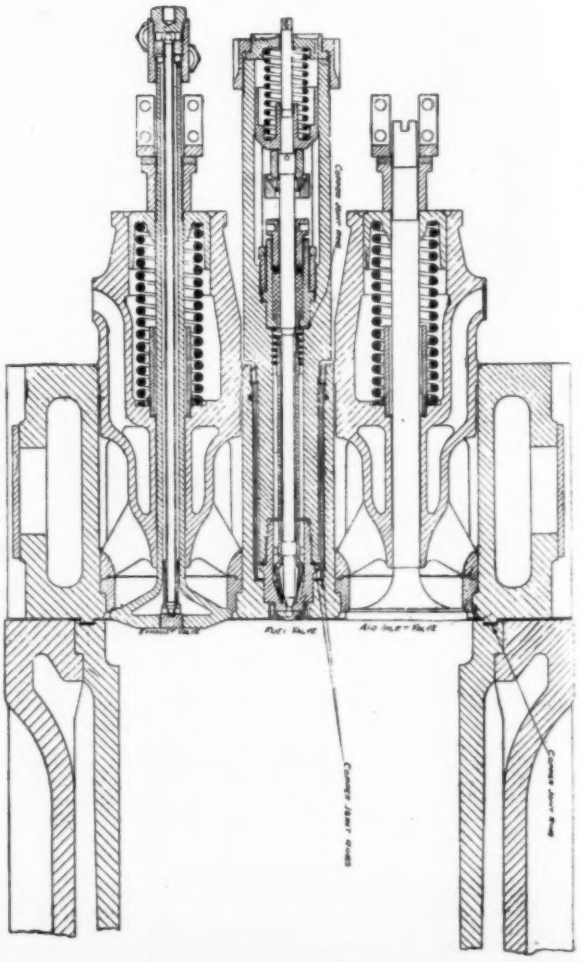


Fig. 2.—Section through Cylinder Cover.

The Electricity (Supply) Bill.—I.

Proceedings in the House of Commons.

ON Tuesday, November 9th, the House of Commons began the consideration of the report of the Electricity (Supply) Bill, as amended in Standing Committee "C." There were 26 pages of amendments on the Order Paper, but as these covered many points raised in Committee, the Speaker exercised his powers of selection, and passed over a large number.

The new clauses were first considered, and Mr. D. HERBERT (Watford, U.) moved a new clause to provide that certain powers of the Electricity Commissioners should be exercised by the Central Electricity Board.

Sir J. NALL (Manchester, Hulme, U.), in seconding, said that, as in Committee it had been decided that the Board must be supreme, the amendment was necessary to avoid friction between the Commissioners and the Board.

Sir D. HOGG, the Attorney-General, resisted the amendment, as, in its present form, it would mean that in all areas in which a scheme was operative, the Electricity Commissioners would be subordinated entirely to the Board. It was not in the least likely that friction would arise between that Board and the Commissioners, but, if it would satisfy Mr. D. Herbert, when Clause 18, which preserved the necessity for obtaining the consent of the Commissioners was reached, he would move to insert words to ensure that, in determining whether to give or withhold consent or approval, the Minister of Transport or the Commissioners should have regard to the provisions of the scheme.

In view of this assurance, the new clause was withdrawn.

A further concession was made by the Government on a new clause, moved by Sir J. Nall, to provide that on the coming into force of any scheme under Clause 4, the powers of the Electricity Commissioners, under the Electricity (Supply) Act, 1919, should, so far as they related to the amendment or alteration of frequency, cease to be exercisable within the area of the scheme. The Board, he argued, could order a change of frequency in any particular area under a scheme, and the Commissioners could, a week afterwards, order another change back to the previous frequency. The cost, instead of being borne by the whole industry, would be borne by the particular area concerned, whereas the Weir Committee insisted that it should not be borne by the industry, much less by the undertaking in a particular locality, but should be paid out of the National Exchequer. If the Board was to be free from negative influence on the part of the Commissioners, the new clause should be accepted.

Sir D. HOGG contended that the power by which the Commissioners might require a change of frequency must be maintained, because there would be parts of the country which would not be under schemes at all. While he could not accept the new clause, he was, however, prepared, on Clause 9, to insert a new sub-section to provide that where a scheme under Clause 4 had come into force as respecting any area, the powers of the Electricity Commissioners under the Act of 1919, so far as they related to the amendment or alteration of frequency, should not be exercisable in that area.

Sir J. Nall withdrew the new clause.

A long discussion took place on the question of the Appeal Tribunal, and many of the arguments put forward in Committee were again advanced. The subject arose on a new clause, again moved by Sir J. Nall, to set up a tribunal of appeal, consisting of five members appointed by the Lord Chancellor for a term of five years and entitled to such remuneration as the Treasury might fix from time to time. He said the Board would, under the Bill, be able to adopt a scheme or series of schemes which might affect the property, and even the statutory obligations of other authorities. Therefore, it seemed only fair that there should be some expeditious and final tribunal to which aggrieved authorities might go. His proposal had a precedent in the London Building Act, 1894. If no such provision were made, the Bill would contain only a very limited form of arbitration to be applied in a few specified cases, an arbitration which could only be claimed by a very limited number of persons. That would be absolutely contrary to the whole of our constitutional procedure and practice, and for the first time in history there would have been denied to municipalities, county councils, and statutory undertakings of all kinds, as well as to private individuals, the right of appeal to Parliament when powers of the kind at present contemplated were being sought in the ordinary process of private Bill legislation or provisional undertaking. If the Government could provide a right of appeal to a properly-constituted and permanent authority, it would go a long way towards removing some of the apprehensions felt as to the possible working of the Bill.

Sir D. HOGG pointed out that when the Bill was originally before the House it gave no right of appeal to an independent tribunal, but the Committee and the Government agreed that it was desirable that in certain cases where there was a real risk of injustice being done, such right of appeal should be provided. It was now provided that, after the scheme prepared by the Electricity Commissioners had been announced, everybody should have an opportunity of making representations. Those representations would be considered by the Board, which would then, so far as was thought fit, modify or amend the scheme. Afterwards anybody on whom any obligation was imposed by the scheme might appeal to an independent arbitrator to be selected from a panel set up by the Lord Chancellor. The panel was confined to people who were qualified to hold judicial offices. There was also an express provision that the arbitrator might call in assessors to assist him in regard to technical questions. That seemed to the Government as far as it could safely go in order to safeguard adequately the interests of affected persons. If the provisions were widened to give anybody affected by the Bill the right of appeal, it would no doubt go a long way to meet the views of those who disliked the Bill, because it would prevent the Bill from becoming law in the lifetime of any member present. When the scheme of the Bill was operating, there were elaborate provisions for appeal where there was any risk of harm being done if appeal was not allowed.

Several Unionist members pressed for a larger right of appeal, and Mr. MACQUISTEN (Argyllshire, U.) remarked that if anyone thought the Bill was going to cheapen electricity they were labouring under a delusion. The clause was, however, eventually negatived.

A new clause, moved by Mr. Looker (Essex, S.E., U.) to allow a local authority supplying electricity to supply also electrical fittings on any condition which might be agreed on, including the hire-purchase system, was agreed to and added to the Bill.

On Clause 1 (constitution of Central Electricity Board), Mr. D. HERBERT moved an amendment to provide that the Board should be appointed or elected from time to time in accordance with a scheme prepared by the Ministry of Transport, which should be as analogous as possible to the statutory provisions regulating the appointment and election of members of the Mersey Docks and Harbour Board. The scheme should not come into force without the approval of both Houses of Parliament.

Sir D. HOGG, in declining to accept the amendment, said that the Government had no intention of setting up a new Government Department. The new Board was to be a body of business men, on the same lines as the Port of London Authority and the Mersey Docks and Harbour Board. That was what the Bill proposed, but the Prime Minister had never suggested that there should be a kind of general election in order to select the eight members of which the new Board was to be composed.

The amendment was negatived.

On Clause 2 (General powers and duties of the Central Electricity Board) amendments were moved by Mr. D. HERBERT to insert words making it the duty of the Board to consider and adopt schemes under Clause 4; to make it their duty also to co-ordinate the supply of electricity by authorised undertakers instead of to supply electricity to those undertakers; and to provide that the Board should not directly exercise their powers except so far as they were unable to enter into any arrangement with authorised undertakers to exercise them on behalf of the Board on reasonable terms. Mr. Herbert explained that the joint effect of the amendments would be to lay down that the primary duty of the Board was to try and co-ordinate the supply of electricity to bring those who were at present concerned in the industry into line and harmony with one another, and only to exercise the power of themselves carrying on that industry if they were unable to get authorised undertakers to do it in a satisfactory way.

Sir J. NALL, who seconded, argued that the Bill really proposed nationalisation, but Mr. ATTLEE (Limehouse, Lab.) said that the Bill did not go far enough in the path of nationalisation.

Sir D. HOGG said that the fact that the Government were being attacked from both sides of the House was proof that the middle way was best. The amendments would wreck the Bill. It was the intention of the Government to co-ordinate the supply of electricity, but it was intended that the generation of electricity should continue to be in the hands of the owners of selected stations. The Government's scheme had none of the objections of nationalisation. The Government desired that generation should remain in the hands of the individual authorised undertaker, and that electricity should be generated in the most economical way and at the most economical site. By the linking up of those sites in the way proposed in the Bill they would ensure a general cheapening of current to the consumer.

The amendment was negatived.

An amendment moved by Mr. Hannon (Birmingham, Moseley, U.) providing that the Board should not delegate any of their powers in respect of selected stations without the consent of the owners of selected stations, was accepted by the Government and agreed to.

Clauses 3 (Appointment of Consultative Technical Committees) and 4 (Preparation and carrying out of scheme) were agreed to without substantial alteration, and the debate was adjourned.

On November 10th, the House considered Clause 5 (Existing selected stations).

Mr. HARDIE (Glasgow, Springburn, Lab.) moved to omit the provision in sub-section (2) to the effect that if the owners of any existing selected station were unwilling to enter into or

failed to carry out any arrangements for additional extensions and alterations which the Central Electricity Board might direct to the satisfaction of the Board, the Minister of Transport might empower any authorised undertakers or other company or person to acquire the station. Mr. Hardie explained that the amendment sought to remove what was an additional support to private enterprise, and to ensure that the Board should acquire and work the generating stations.

Sir D. Hogg said he could not accept the amendment. The Government believed that it would get more efficient generation if the stations were in the hands of existing authorised undertakers. The Board ought to be the controlling and not the generating authority. The sub-section was very unlikely to become operative. It would, in fact, only come into operation if, after an arbitrator had decided that the requirements of the Board were not reasonable, the owners of the generating station refused to carry them out.

The amendment was rejected by 225 votes to 84.

An amendment moved by Mr. R. Hudson (Whitehaven, U.), to provide that the first option to acquire a selected generating station should be given to the joint electricity authority in any district where such an authority had been constituted, was accepted by the Government, and agreed to. An amendment, moved by Col. Ashley, the Minister of Transport, was also agreed to. It provided that the Board should not itself operate a generating station until it had first endeavoured to enter into arrangements with the joint electricity authority, when the generating station was situated in an electricity district where such an authority had been constituted.

On Clause 6 (New selected stations) the House agreed to an amendment, moved by Mr. R. Hudson, providing that where an area of supply is situated in an electricity district for which a joint electricity authority has been constituted, the Board shall first endeavour to enter into arrangements with the authority for the provision of any new generating station required by a scheme.

On the motion of Sir D. Hogg, a new sub-section was added to Clause 7 (Obligations and rights of owners of selected stations) to provide that the Board shall make to the owners of each selected station monthly payments on account of the net amounts due from the Board to those owners under the section in accordance with estimates made for the purpose, subject to adjustment as soon after the end of the year of account as the actual liability can be ascertained.

Further amendments agreed to provided that for the purposes of the agreements contained in the third schedule to the London Electricity Acts of 1925, the Board in relation to the electricity purchased by it from the owners of selected stations under the clause should not be deemed to be a consumer; and made it obligatory, instead of permissive, on the Board, if required, to advance, free of interest, such sums as might be necessary to enable authorised undertakers or owners to amend or alter the frequency as required by the Board.

Clause 8 (Construction and acquisition of main transmission lines) passed with drafting amendments. On Clause 9 (Standardisation of frequency) amendments, moved by Sir D. Hogg, were agreed to, providing that the interest and sinking fund on money borrowed for the purpose of carrying out standardisation of frequency shall be repaid by the Electricity Commissioners to the Board, and that this expenditure shall be spread over the whole of the revenue received from the sale of electricity and apportioned between the different suppliers, in proportion to the revenue received; to provide that nothing in the clause shall prevent the Board and the authorised undertakers or owners concerned from entering into an agreement fixing the sum to be taken in discharge of the liability of the Board to the undertakers or owners under the section; and to provide that where a scheme under Section 4 of the Act has come into force as respects any area, the powers of the Electricity Commissioners under Section 24 of the Electricity (Supply) Act, 1919, so far as they relate to the amendment or alteration of frequency, shall not be exercisable within that area.

On Clause 10 (Obligation of Board to supply electricity to authorised undertakers) Sir D. Hogg moved an amendment, which was agreed to, giving any aggrieved undertaker the option of appealing either to the Electricity Commissioners or the arbitrator.

Speaking on another amendment on Clause 11 (Tariff for electricity supplied directly by Board), Sir D. Hogg said that the Bill provided for different areas, and there was every intention that where there were different costs there should be different charges. He hoped that in the ultimate future, as the country became more and more linked-up and inter-connected, it might be possible to equalise tariffs. But for a long time tariffs in the more efficient areas would be lower than tariffs in the less efficient areas.

On Clause 12 (Price of indirect supply in bulk) the Government refused to extend to other undertakers the privilege of the railways, which can take their supply in bulk at cost price.

The debate was adjourned.

Rapid progress was made on November 11th, and, before the House adjourned, the report stage was concluded.

A number of clauses were passed with little or no amendment. On Clause 19 (Application of Electricity Supply Acts to Board), the following amendment, moved by Col. Ashley, was agreed to: "Before any such regulations [made by the Electricity Commissioners] come into force they shall be laid before each House of Parliament for a period of not less than thirty days on which that House is sitting, and if either House of Parliament, before the expiration of that period, present an Address to His Majesty no further proceedings shall be taken thereon."

A further amendment, moved by Col. Ashley, to provide that the Central Electricity Board should pay to the Minister of Transport any expenses and liabilities incurred before the commencement of the Act preliminary to the preparation of schemes, together with interest at the rate of 5 per cent. per annum. He said that about £20,000 had been spent by the Ministry in collecting data for the Electricity Commissioners, and it was proper that the taxpayer should be repaid by the industry.

There was much Unionist opposition to Clause 27, which authorises the Treasury to guarantee the payment of the interest and principal of any loan proposed to be raised by the Board, provided that the aggregate amount of the loans does not exceed £33,500,000. Sir F. Wise (Iford, U.) moved to omit the clause, stating that certain City men would probably be willing to take up this big issue, spread over a number of years. He could not conceive that any Chancellor of the Exchequer who had gone into the figures would agree to the guarantee, because he would lose money. If, instead of the money being guaranteed at 5 per cent., it were lent at 6 per cent., the Treasury would rope in an additional £67,000 in income tax. The security would be ample, and it would be to the advantage of the investor, the taxpayer, and the Treasury that the guarantee should not be given. The taxpayer could not afford to give the guarantee. The Government had been very loose in dealing with our credit in the last two years. The guarantee was a wicked guarantee, and it was time the House protected the taxpayer and the national credit.

Sir D. Hogg, in reply, said that the Chancellor of the Exchequer had from the first heartily approved and supported the Bill, because he was satisfied that its financial provisions were right and proper and in the interests of the country. The Weir Committee had suggested that there should be first a gift of £8,500,000 from the Treasury, and then a guarantee of the amount to be raised in addition. The scheme had to be established before it would inspire the confidence of the investing public. If it was necessary in the first instance to provide a guarantee, it was far more necessary now that attacks had been made on the scheme, which were found to have a prejudicial effect on the confidence of the public. The object of the guarantee was to ensure the success of the scheme, which would benefit not one class but the whole community. This wise use of credit would increase the stock of national wealth, and in the long run add prosperity to the country.

On a division Labour members supported the Government, and Sir F. Wise's amendment was negatived by 291 votes to 33—Government majority 258.

Clause 35 deals with the amendment of schemes, and Sir D. Hogg moved a new proviso applying the provisions as to compensation for deprivation of employment to the officers and servants of any advisory board which might afterwards be turned into a joint authority. The amendment was agreed to, as was another moved by Sir D. Hogg to Clause 36 (Provisions as to companies with large areas of supply), defining the area of supply as one which consisted of, or included, the whole of the districts of two or more local authorities, and was in the opinion of the Electricity Commissioners adequate in extent.

On Clause 44 (Interpretation) an amendment moved by Sir P. Dawson (Lewisham, U.) laying it down that where it was necessary to calculate what the cost of taking a supply of electricity from the Board over a number of years would be, it should be assumed in making the calculation that the price of fuel and the rates of wages remained constant, was agreed to.

On the Schedule, an attempt by Labour members to provide that compensation should be paid to workers and servants for loss or relinquishment of employment on the same principle as to officers on annual salary, was defeated by 177 to 94—Government majority, 83.

An amendment moved by Mr. Attlee providing that the amount which might be applied in aid of the local rate in any year from the net surplus on a municipal electricity undertaking should not exceed 1½ per cent. of the "outstanding debt on the undertaking," instead of "the aggregate capital expenditure on the undertaking," as provided in the Bill, was agreed to, as was also an amendment moved by Mr. Fielden (Manchester, Exchange, U.) to safeguard the electrical control of railways. An amendment moved by Sir D. Newton (Cambridge, U.) giving County Councils the right to be heard in cases where it was proposed to carry overhead lines over roads or bridges for which they were responsible, was also agreed to.

This concluded the report stage, and the House adjourned.

On November 12th, Lt.-Col. Moore-Brabazon, Parliamentary Secretary to the Ministry of Transport, moved the third reading of the Bill. He said that the Board's work in the future would be to do what everybody had wanted to do, but which it had been nobody's business actually to effect—that was, to build a grid of intercommunicating lines between the various generating stations in the country. It was not possible to envisage any area which could be looked upon as efficient if stations were not connected. The North-East Coast Company was a model which he would like to see the whole of England follow. It was a matter of great regret that that very efficient organisation had been one of the bitterest opponents of the Bill. The company objected to the Bill because they believed that the Board would "mess them about." After all, the Board's work under the Bill was to see that

the generation of current in this country was carried on as efficiently as possible, and unless the men appointed to the Board were quite incapable and unsuitable, they surely would not destroy the model which it was their duty to imitate. Standardisation of frequency would be of very great advantage to everybody. The grid would be a reservoir for all the power at present going to waste. Power from any new coal treatment could be poured into it; water-power going to waste—250,000 h.p. was being wasted at present—could be turned into it; and who knew whether soon we should not be able to put tidal power into it? It was necessary that a Bill of this kind should be passed now, because in another few years it would be impossible, from the point of view of cost, to effect standardisation.

Mr. ATTLEE, on behalf of the Labour Party, moved an amendment asking the House to reject "a Bill which, while purporting to secure a unified system of electricity supply, fails adequately to protect the public interests and perpetuates the existence of private ownership in a service which ought to be owned and controlled by the community and co-ordinated with the scientific production and utilisation of coal." In the debate which followed, Labour members condemned the Bill because it was not nationalisation, and some Unionists, including Sir J. Nall and Mr. G. Balfour, condemned it because it was Socialistic and would, in their view, lead to nationalisation. Such authorities as Sir P. Dawson and Sir R. Sanders (the chairman of the Committee which considered the Bill), however, supported the third reading.

Sir D. HOGG, in a final summing-up, heaped scorn on his Unionist critics, and said that the Bill had none of the objectionable features of nationalisation. Indeed, the Government believed that if it did not pass, if it were emasculated or destroyed in that House or elsewhere, the result would be that people, seeing that the state of electrical development in this country urgently called for reform, that the price of electricity was far too high, and that the production and consumption were far too low, if they found out that that remedy proposed by the Conservative Party, could not be brought into operation, would perforce turn to the disastrous doctrine of Socialism. The Bill would preserve the essential principles on which our economic greatness had been built up; and the result of its passage into law would be that there would no longer be any demand for the nationalisation of the electrical industry because there would no longer be any abuses to reform. It was true that the effect of the Bill would be to perpetuate the existence of private ownership. The Conservative Party believed in private ownership. They intended to perpetuate its existence by removing its abuses, and he asked the House, by supporting them, to defeat the prospect of Socialism and to say that the Conservative Party was able to provide a sensible, progressive, and safe cure.

The amendment was rejected by 201 votes to 70—Government majority 131—and the Bill was read the third time, and sent to the House of Lords for a formal first reading on November 16th.

The following is the text of the new clause relating to the sale of fittings:—

(1) Subject to the provisions of this Section a joint electricity authority and any local authority authorised by special Act or by Order to supply electricity may sell electric lines, fittings, apparatus, and appliances for lighting, heating, and motive power, and for all other purposes for which electricity can or may be used (in this Section called "electric fittings"), and may install, connect, repair, maintain, and remove the same, and with respect thereto may demand and take such remuneration or rents and charges, and may make such terms and conditions as may be agreed upon.

(2) The exercise of the powers of this Section shall be subject to the following restrictions:—

(*a*) The joint electricity authority or local authority shall not manufacture electric fittings unless expressly authorised to do so by special Act or Order;

(*b*) The joint electricity authority or local authority shall not sell electric fittings except—

(i) to a consumer or a person who intends to be a consumer of electricity supplied by them; or

(ii) to a contractor who requires such fittings to enable him to supply them to a person who is, or intends to be, a consumer of electricity supplied by the joint electricity authority or local authority;

(*c*) The prices charged by a joint electricity authority or a local authority for the sale of any electric fittings shall not be less than the recognised retail prices, unless the sale is to a contractor, in which case the prices shall not be less than the recognised trade prices, and if any question shall arise as to what are the recognised retail or trade prices of any electric fittings, that question shall be determined by the committee appointed as hereinafter provided;

(*d*) Every such joint electricity authority or local authority shall so adjust the charges to be made by them under this Section as to meet any expenditure incurred by them in the exercise of the powers of this Section (including interest upon and sinking fund charges in respect of money borrowed for the purposes of this Section);

(*e*) The total sums received and expended by any such joint electricity authority or local authority under this Section in each year, including interest upon and sinking fund charges in respect of money borrowed for the purposes of this Section, shall be shown separately in the published accounts of the electricity undertaking of such joint electricity authority or local authority.

(3) The Electricity Commissioners shall appoint a committee comprising representatives of associations representing local authorities who are authorised undertakers, contractors, and persons engaged in the business of making and persons engaged in the business of selling electric fittings, such committee to be appointed after consultation with those associations, and that committee shall determine any question which may be raised under this Section as to the recognised retail or trade prices of any electric fittings, and shall advise and assist the persons concerned as to the method of giving effect to the provisions of this Section.

(4) The purposes of this Section shall be deemed to be purposes for which the joint electricity authority or the local authority may borrow money.

(5) In this Section the expression "contractor" means a person engaged in the business of selling and installing electric fittings.

Legal.

Corporation Profits Tax Appeals.

MR. JUSTICE ROWLATT, in the King's Bench Division, had before him two appeals from corporation profits tax assessments on November 9th, of which reports appeared in the *Financial Times*.

The first was an appeal of the Crown regarding assessments made upon the City of Buenos Ayres Tramways Co. It was stated that the respondent company had taken over an old company of the same name, the latter paying an annual sum of £70,660, a sum of £111,500 for the formation of a redemption fund, and a further sum as compensation. In resisting claims of £3,578 and £3,642 for 1920 and 1921, respectively, as corporation profits tax, the company said that it was not carrying on a trade or business; its profits comprised the interest contained in the annual payment, the interest on the redemption fund, and certain rents from properties. His Lordship held that the company was carrying on a business. With regard to the point whether the debenture interest paid by the new company could be deducted, he said that he would give a decision later when the facts were put before him. He allowed the appeal with costs.

The other case was an appeal by the Birmingham and District Power and Traction Co. against assessments of £6,000 and £8,500 in respect of the profits of subsidiary companies.

Mr. A. M. LATTER, K.C., for the appellants, said that the company was exempt from corporation profits tax, its tolls being restricted by Acts of Parliament. The company held, during the period in question, all the issued ordinary shares in the Birmingham and Midland Motor Omnibus Co., which, in turn, held all the ordinary capital of two other motor omnibus companies. When assessments were made on the three subsidiaries, appellants applied that the profits of the Birmingham Omnibus Company should be treated as their own profits, and later asked that the profits of the other two companies should be treated as though they were branches of the Birmingham Omnibus Company. The assessments on the three subsidiaries were accordingly discharged and the assessment upon the appellants was upheld by the Commissioners.

The appellants now contended that the profits of the subsidiary concern formed part of their whole undertaking and were therefore not liable to the tax.

His Lordship, while agreeing that the verbal argument appeared to be good, said that he could not construe the section of the Finance Act dealing with the treatment of subsidiaries as branches, as meaning that a company liable to the tax and amalgamated for duty purposes with another company could avoid the duty. The appeal would therefore be dismissed with costs.

Theft of a Wireless Set.

AT the Central Criminal Court on November 11th, the Common Serjeant, Sir H. F. Dickens, K.C., sentenced Constantine Papazolow, described as a "wireless expert," to three months' imprisonment in the second division for the theft of a radio set and the conversion of £25 to his own use and benefit. It appeared that defendant, who was formerly employed by a wireless firm, called upon one of that firm's customers and offered to put a set in proper working order. He was paid £25 in advance and took the set away. He later confessed that he had used the money for another purpose and endeavoured to sell the set. It was stated that the prisoner had previously committed a similar offence.

Impex Electrical, Ltd., v. Norton Wireless Co.

MR. JUSTICE TOMLIN, in the Chancery Division, on November 12th, heard a motion by Impex Electrical, Ltd., of Leytonstone, for an injunction restraining the Norton Wireless Company, Norton Folgate, E.C., from infringing its trade mark, the word "Daring," in connection with radio valves.

Counsel for plaintiffs said that his clients imported French valves and a representative bought a valve bearing their mark at the defendants' premises, drawing it from a carton. The defendants, however, stated that although they sold a valve that was not the one taken from the carton. In view of this conflict of evidence, the parties agreed to his Lordship's suggestion of an early trial, an undertaking being given in the meantime.

Boyce v. Morris Motors, Ltd.

IN the Chancery Division, on November 12th, Mr. Justice Astbury had before him an action by Mr. Harrison Hurlbert Boyce, of Jericho, Long Island, New York, against Morris Motors, Ltd., Oxford. The plaintiff claimed an injunction to restrain the defendant company from infringing his letters patent, No. 7,679 of 1913, for an invention of "means for indicating variations of temperature of the cylinders of internal combustion engines." He also claimed damages, and delivery up or the destruction of all temperature indicators in the defendants' possession or control, constructed or arranged for use in infringement of his letters patent. Mr. Boyce said he was the registered legal owner of the letters patent, which were valid and subsisting. He alleged that the defendant company had infringed and threatened and intended to infringe them.

The defendants denied that they had infringed or threatened or intended to infringe as alleged. They said the letters patent were and always had been invalid, and that the invention was not novel, and they set up prior publication, prior public user, and prior common general knowledge. Further, they said the invention was not proper subject matter for letters patent and that it was not useful.

Evidence was given for the plaintiff by Messrs. J. Swinburne and Mr. K. S. M. Ffennell (sales manager to Benjamin Electric, Ltd., the licensees for the device in this country), and the plaintiff's case was concluded. After an opening statement by Sir A. Colefax, K.C., for the defendants, the hearing was adjourned.

Primrose & Primrose v. Price.

AT the Glasgow Sheriff Court on November 9th, Messrs. Primrose & Primrose, electrical engineers, Glasgow, sued Mr. F. G. Price, Scotstoun, for £32, the balance of an account. It was stated in evidence that the plaintiffs fitted up an aerial for the respondent at a cost of £11 4s. and supplied a receiving set for £84. It was an essential condition of the contract that the set should be able to cut out the Glasgow station and to receive other stations. The respondent claimed that the set did not conform to this condition, and although the plaintiffs repeatedly sent representatives to adjust the set, they failed to make it satisfactory, and the set was therefore rejected. The respondent had paid £60 and refused to remit the balance. He counterclaimed for £48 16s., being the difference between the sum already paid and the cost of the aerial which he accepted. The Sheriff found in favour of the respondent upon both the claim and counterclaim.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 10th:—

Serpent (design only). No. 466,268. Class 5. Metals and alloys in the form of wires, strips, rods, sheets, bars and ingots for use in electrical manufactures.—Henry Wiggin & Co., Ltd., Birmingham.

N. & K. (lettering and design). No. 447,815. Class 8. Headphones and loud speakers, all being instruments for use in radio-telephony.—Neufeldt and Kuhnke, Kiel, Germany. (British representatives: L. J. Hydleman & Co., 32, Queen Victoria Street, E.C.4.)

Electome (lettering and design). No. 471,641. Class 8. Electric time switches.—Graham Cotterell, 16, The High, Wanstead, E.11.

Telemitter. No. 472,837. Class 8. Apparatus for use in transmitting views, scenes, or images to a distance by telegraphy.—Television, Ltd., Motograph House, St. Martin's Lane, W.C.2.

"Science" and the American Association.—By an agreement entered into between the owner of the journal *Science* and the American Association for the Advancement of Science, the journal, which since 1900 has been the official organ of the Association, will eventually become the absolute property of that body. It was founded in 1883 by Alexander Graham Bell with the co-operation of his father-in-law, and for many years was financially assisted by them. The present owner and editor, Mr. J. McKeen Cattell, acquired it (in a suspended condition) in 1894, and set a high standard. Only in recent years has it been self-supporting, its subscribers now numbering 11,000; since 1900 it has been sent to all members of the American Association, which greatly increased its membership after that arrangement was made (from 1,200 in 1900 to 14,000 to-day). The Executive Committee of the American Association voted hearty thanks to Dr. Cattell for his generous offer, which was unanimously accepted. A journal of the same name was published in New York during 1881 and 1882; it was founded by Mr. T. A. Edison, but ceased publication after about a year. The title and goodwill were purchased by Mr. Bell for £1,000.

We are pleased to express the high esteem in which we hold our contemporary, which has been so admirably conducted by Dr. Cattell and occupies a high place in scientific literature.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925

13,100. "Dynamo-electric machines for frequency conversion." Siemens-Schuckertwerke Ges. December 3rd, 1924. (244,039.)

15,003. "Electrical signalling systems for indicating and/or recording and/or counting movements from a distance." G. Kent, Ltd., and A. H. Avery. June 16th, 1925. (260,012.)

15,872. "Terminals, connectors, or binding-posts." J. J. Rowe. June 19th, 1925. (260,014.)

15,989. "Automatic and semi-automatic telephone systems." Standard Telephones and Cables, Ltd., and J. R. Gould. June 20th, 1925. (260,015.)

16,150. "Construction of earthplates." W. C. Fisher. June 23rd, 1925. (260,016.)

16,331. "Telephone systems." Standard Telephones and Cables, Ltd. (L. Polinkowsky). June 24th, 1925. (260,018.)

16,445. "Automatic telephone systems." Standard Telephones and Cables, Ltd., A. M. Searle, J. H. E. Baker, A. J. Chanter, and W. R. Moscrip. June 25th, 1925. (260,022.)

17,528. "Apparatus for combining several electric conductors into a composite conductor." Siemens-Schuckertwerke Ges. July 8th, 1925. (Convention date not granted. Addition to 236,944.) (236,946.)

18,055. "Electric lamps for use on board ship." A. R. T. Woods. July 15th, 1925. (260,025.)

18,304. "Telephone systems." Standard Telephones and Cables, Ltd. (F. A. Roome and C. E. Stevens). July 17th, 1925. (260,029.)

18,318. "Electron-discharge apparatus." British Thomson-Houston Co., Ltd. July 17th, 1924. (237,276.)

18,477. "Electrically-driven lawn-mowers." H. Watson & Sons, Ltd., and E. Watson. July 20th, 1925. (260,032.)

18,519. "Means for damping oscillating or alternating current circuits." N. H. Clough. July 20th, 1925. (260,035.)

18,520. "Thermionic amplifiers and the like." H. J. Round. July 20th, 1925. (260,036.)

18,580. "Apparatus for determining and measuring small changes of frequency of electric oscillation circuits." H. Lowy. July 21st, 1925. (260,038.)

18,611. "Magnetic material." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). July 21st, 1925. (260,039.)

18,766. "Telephone systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). July 23rd, 1925. (260,048.)

18,800. "Holders for globes, shades, and the like." Miller Co. October 20th, 1924. (241,524.)

18,801. "Holders or supports for lighting shades, reflectors, and the like." Miller Co. December 11th, 1924. (244,411.)

18,802. "Holders for globes, shades, reflectors, and the like." Miller Co. February 25th, 1925. (248,316.)

18,803. "Lighting fixtures." Miller Co. March 18th, 1925. (249,462.)

18,804. "Lighting fixtures." Miller Co. April 23rd, 1925. (251,225.)

18,805. "Holders for globes, shades, and the like." Miller Co. April 23rd, 1925. (251,226.)

18,958. "Current-collecting devices for dynamo-electric machines." British Thomson-Houston Co., Ltd., and A. A. Pollock. July 25th, 1925. (260,052.)

19,767. "Holders or adaptors for thermionic valves." Benjamin Electric, Ltd., and K. S. M. Ffennell. August 5th, 1925. (260,060.)

19,811. "Electrical signalling systems, particularly wireless receiving systems." G. W. Hale and R. Lyle. August 6th, 1925. (Addition to 223,630.) (260,061.)

19,901. "Process of precipitating hafnium and zirconium on an incandescent body." W. J. Tennant (Naamlooze Vennootschap Philips' Glocilampenfabrieken). August 7th, 1925. (260,062.)

20,351. "Modulating systems for high-frequency electric signalling." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). August 13th, 1925. (260,067.)

24,146. "Multiplex line and radio telegraphy." Marrec, Ltd., and A. Anderson. September 28th, 1925. (260,087.)

24,441. "Wireless aerials." K. T. Hardman. March 16th, 1926. (260,089.)

25,925. "High-frequency transformers or electromagnetically-coupled coils carrying high-frequency currents." W. S. Worthington. October 16th, 1925. (260,098.)

27,307. "Electric glass-annealing lehrs." V. F. Feeny (Illinois Pacific Glass Co.). October 30th, 1925. (260,104.)

29,413. "Vacuum tubes." Dubilier Condenser Co. (1925), Ltd. November 21st, 1924. (243,381.)

29,537. "Shields for use with electrical appliances." B. Hughes. November 23rd, 1925. (260,116.)

29,938. "Electric transformers." British Thomson-Houston Co., Ltd., and A. A. Pollock. November 26th, 1925. (260,117.)

30,557. "Mounting of electric generators on internal-combustion engines." Douglas Motors, Ltd., and C. G. Pullin. December 3rd, 1925. (260,119.)

31,135. "Telephone systems." Siemens & Halske Akt. Ges. December 11th, 1924. (244,472.)

31,794. "Reproduction of sound by electrical means." Gramophone Co., Ltd. (Victor Talking Machine Co.). December 16th, 1925. (260,125.)

32,478. "Heating elements for electric fires, radiators, and the like." H. H. Berry. December 23rd, 1925. (260,130.)

1926.

1,242. "Improvements in or relating to telephone transmission measuring instruments." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). January 15th, 1926. (260,137.)

2,280. "Illuminating devices." J. Stanley. March 5th, 1925. (248,716.)

4,461. "Electromagnetic apparatus for the interconversion of electrical and mechanical oscillations." British Thomson-Houston Co., Ltd. December 1st, 1925. (260,148.)

6,393. "Portable electric lamps for miners." J. G. Daloz. August 17th, 1925. (256,923.)

7,869. "Starting devices for internal-combustion engines." Knorr-Bremse Akt. Ges. and T. Kollinek. March 22nd, 1926. (260,155.)

11,935. "Controlling switch devices for electrically-illuminated signs, advertisements, and the like." N. Gollwitzer and S. Hamaguchi. May 7th, 1926. (260,173.)

13,459. "Means for compensating the forces in voltage regulators." Naamlooze Vennootschap Machinerieen en Apparaten Fabrieken. May 27th, 1925. (252,729.)

13,974. "Supersonic heterodyne receivers for high-frequency electric signals." Westinghouse Electric and Manufacturing Co. June 10th, 1925. (253,514.)

14,357. "Electric safety lamps for miners." J. G. Daloz. June 24th, 1925. (254,291.)

14,576. "Electrically-driven locomotives." E. C. R. Marks (Swiss Locomotive and Machine Works). June 9th, 1926. (260,185.)

16,327. "Shades for incandescent electric lamps." H. Francis. June 29th, 1926. (260,195.)

16,507. "Headlights for automobiles and like vehicles." C. G. Picard and L. F. R. Picard. July 29th, 1925. (256,197.)